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THE EFFECT OF FROSTING INCANDESCENT LAMPS.

The practice of frosting the bulbs of incandescent lamps, in order to produce diffusion and to hide the brilliant filament, is old, and although the effect is good, there has always been some prejudice against it because it is believed to reduce the life of the lamp. Frosting the bulb cuts down the light given by a lamp, because it increases the absorption, but other than this there would, at first thought, seem to be no reason why it should affect the lamp deleteriously, but it has generally been accepted that some further effect does take place. On another page of this issue Dr. E. P. Hyde gives the preliminary results of an investigation into this subject. This investigation was not easy to carry on, because there are certain factors not perfectly under control. It is not practicable to test the same lamp both with a frosted and unfrosted bulb; therefore a comparison must be made between different lamps, upon the assumption that under similar conditions they would behave in the same way. Moreover, the frosting of the bulbs is likely to be different for different lamps, so that the only way to obtain accurate results is to carry out a large number of tests. The preliminary work, however, enabled Dr. Hyde to offer an explanation of the effect.

It is first pointed out that some confusion has arisen in this matter. Frosting does not shorten the life of the lamp—that is to say, a frosted lamp will burn as long as an unfrosted one; but it causes the candle-power of the lamp to decrease more rapidly than that of unfrosted lamps. It is well known that the bulbs of frosted lamps are generally hotter than clear bulbs. This, of course, is due to the increased absorption, but it seems unlikely that it should have any effect upon the life of the filament.

The explanation is a simple one, and seems to fit the case. With a frosted bulb a greater amount of the light falling upon the glass is reflected back into the bulb, and must encounter the glass a second time, or even oftener, before it finally passes through. No doubt certain rays are reflected a number of times before they succeed in passing through the glass. At each reflection the ray of light must pass twice through the deposit of carbon which takes place on the inner surface of the bulb, in addition to passing a similar number of times through the glass itself. At each one of these passages there will be a certain loss of light, and if there be much reflection there should be a corresponding increase in absorption. The tests which have been made are in agreement with this explanation, and it is no doubt the true one, yet further results will be awaited with interest. It suggests that

lamps which are given to causing the blackening of the bulb should not be frosted. It is interesting to note that this rapid decrease in candle-power of frosted lamps should not occur with those newer types of filaments which are said not to blacken the bulbs. However, if any opaque deposit be formed on the inner surface of the bulb this same action will, of course, take place. Frosted globes or shades should cause the same effect, though to a much less degree. But dust on the inner surface of a frosted globe should be particularly objectionable, as here it resembles the deposit on the inner surface of the bulb.

DIRECT-CURRENT SERIES TRANSMISSION.

The direct-current series system of transmitting electrical energy continues to receive a good deal of attention, in spite of the fact that it is making but little headway in application. It at present is limited in use to a few plants in the southern part of Europe, one of which is of recent installation. It was considered for the proposed Victoria Falls water power development, but there are other serious problems entering into the latter undertaking, so that it seems unlikely either that it or any other system will be put into operation there for some time.

An interesting discussion of this system was given recently before the Institution of Electrical Engineers, of Great Britain, by Mr. J. S. Highfield, in which, while the author did not describe any new developments, still some interesting features of the system were brought out. One point upon which much of the advantage claimed for this system rests is that by using direct current the strain upon the insulators for a given effective voltage is decreased, and therefore a correspondingly higher pressure may be employed. Usually the ratio of the strains has been taken as that between the direct-current pressure, which is, of course, constant, and the maximum pressure due to the alternating current. Mr. Highfield, however, would give the direct-current system a much greater advantage in this respect. He quotes recent experiments made by Thury by means of five high-potential, direct-current generators, three of these being of 22,000 volts and the other two of 25,000. These machines were built with fixed commutators and armatures, and revolving brushes and fields, and although the voltage between adjacent segments of the commutator was at times 500, it is said the machines operated successfully. These machines were used to test the effect of high potentials on insulators and insulating materials. The comparatively small number of commutator segments produced a wavy potential characteristic which was somewhat unfavorable to the direct current; and, further, the alternating-current generator used had a rather flat wave-form, still further increasing the advantage of the alternating system. In spite of this it was found that the strain on the insulators due to the alternating current was considerably greater than that given by the ratio of the effective to the maximum potentials of the alternating system. Indeed, it was found that there was no brush discharge with a direct-current high-potential, and that ordinary telegraph insulators, if well vitrified, would not break down under 60,000 volts. Tests of fibre sheets, five millimetres thick, showed that an effective alternating pressure of 9,000 to 11,000 volts would puncture it, while successive applications of two minutes each of direct-current pressure, increasing in steps, did not produce a puncture up to 20,000 volts. At 25,000 volts the fibre was punctured after an application of four minutes. Slabs of marble twenty millimetres thick were easily punctured with alternating pressures of 20,000 volts, but were not punctured by the direct-current pressure until 45,000 volts were reached and an exposure of two minutes allowed. From these experiments Mr. Highfield feels justified in giving the direct-current system an increased advantage; in fact, he thinks is would be allowable to use direct-current pressures two and one-half times greater than the mean effective alternating pressure. Such an increase in pressure, if found practicable, would mean a greatly increased distance of transmission, although, of course, other considerations must enter in.

In addition to this very decided advantage the following are given to the direct-current system: the switchboard gear and regulating apparatus are considerably simplified, an advantage which has frequently been pointed out; in fact, the simplicity of these accessories is one of the striking features of the direct-current system; further, it is easy to work a number of stations in series on the series system. In this way the more efficient stations may be kept in service, the less efficient being run only when necessary. There is not such a great advantage here, as alternating-current systems may be operated in parallel; but there would be some gain so far as regulation of the system were concerned. It is, of course, easier to maintain a constant current throughout a long series line than to maintain a constant potential at all points of a widely distributed parallel system.

Another advantage, less important in some cases, though perhaps of value in others, is that on the series system an increase in load is provided for by an increase in pressure. There is no need to add copper to the distributing system, unless it be to reach a new consuming point. On the other hand, the entire conductor must be carried to every point that is supplied, so that it is not practicable to take on any small consumers. The series system is limited to a transmission from one or more power stations to substations which supply local needs. In this respect it stands about on a par with the alternating system. One point, however, is the reduction in the number of insulators required, and the simplicity of the pole line construction. Of course, in any such system, separate pole lines would be used for the outgoing and returning conductors.

The discussion which took place on this paper was interesting, because of the position taken by some of the most distinguished British electrical engineers. Lord Kelvin, for example, said that he had always been in favor of a direct-current series system. Although the polyphase system is very beautiful, it did not seem to him as suitable for long-distance transmission. He took the stand that work so far showed that it is easier to operate an 80,000-volt direct-current line than a 40,000-volt alternating-current line, and that this proved the case for the direct-current system. Professor Gisbert Kapp

also took about the same stand, although until recently he was an advocate of the polyphase system. Personal inspection of one of the Thury systems had, however, convinced him of its superiority. It is true that such systems involve the use of commutators, but recent dynamo design has provided means for overcoming commutation difficulties. One new difficulty, however, is the need of insulating high-potential, direct-current machines from the prime movers. This could be overcome by means of flexible couplings, the metallic parts of which were widely separated. One important advantage which the direct current had was the reduction in line losses due to the insulators. Tests which had been made under rainy conditions showed that at 50,000 volts alternating current there was a loss of five and one-quarter watts at each insulator. On a 70,000-volt circuit the loss was about double, and must amount to a very considerable item. This loss does not occur in the direct-current system, because the insulators are subjected to a steady, not a varying, strain, and since the loss does not take place, they are not heated, and this was one of the reasons why the higher voltage was attainable.

It can not be denied that the direct-current system has some decided advantages, the most important of which is the possibility of using much higher voltages. It can therefore be used for much greater distances of transmission than can the polyphase system under the present conditions. Another fact which should be borne in mind is that the direct-current series system, as it stands to-day, is practically the result of the work of one man. Thury must certainly be given much credit for the pioneer work which he has conducted so successfully. There are, however, important advantages in favor of the alternating system, one of which is its flexibility and the ease of subdivision. The latter feature is one of very great weight and will probably decide the question, except for exceptional situations, such, perhaps, as that in South Africa, where there is practically but one consuming point several hundred miles from the source of supply. Nevertheless, it is a fact that a number of distinguished electrical engineers have declared in favor of the direct-current system, so that it is not wise to turn it down lightly, and its possibilities should be carefully studied.

COPPER.

Copper is a metal distinctively connected with the electrical industries. While it is true a great deal of copper is used in other industries, next to iron it is the most important material which is employed for the construction of electrical apparatus. The production of copper and its price are, therefore, matters of considerable interest to the electrical world. A recent report of the department of mineral resources of the United States Geological Survey gives, in addition to information relating to all these materials, statistics for the production of copper up to and including the year 1905. In that year the total value of our mineral resources, which include iron and coal, and everything else of that character, was about $1,624,000,000. The value of the copper alone was about $140,000,000. In other words, the value of the copper produced was over eight and one-half per cent of that of all the minerals. More explicitly, the production was about 403,000 tons. It is estimated that in 1906 this amounted to about 433,000 tons.

The total production of the entire world during 1905 was 701,000 tons. The United States chief producing districts are Montana, Lake Superior and Arizona, in the order named. All of these districts showed a considerable increase, though the percentage increase of Arizona was the greatest; in fact, Arizona and a few other states are rapidly becoming important copper producing districts. This will, no doubt, have some effect in keeping down the price of this material, although this has been increasing during the last few years, due to the great demand. The United States is still the great copper producing district of the world. Europe produced during 1905 about 88,000 long tons; South America, less than 40,000; Africa about 46,000; Canada, 25,000, and Mexico about 70,000.

PIPE TUNNELS.

Now as the weather modifies and the accumulated snow and mud disappear from city streets, the defects in the pavements, hidden by these coverings, are seen, and they call attention to a municipal problem which needs immediate attention.

Of course, the pavement may be laid imperfectly, and hence develop faults; but it is more likely that these faults are the result of patching made necessary by holes cut in it. Water, gas and steam pipes, however carefully laid, can not last forever. Faults will develop, changes must be made, and when such an occasion arises a hole must be dug to reach the pipe in question. Unfortunately, such occasions are all too frequent. They are not only an annoyance by interfering with the traffic, but are frequently objectionable in other ways. But, worst of all, no matter how carefully the hole be filled and the pavement patched, a perfect mend seems impossible. Sooner or later a fault develops there.

The electricity supply companies used themselves to be frequent offenders in this way, but now, where they are forced underground, the accepted practice is conduit lines laid down once for all. After they are laid there is no further disturbance of the pavement, because the cables may be withdrawn, replaced and repaired at will without cutting the street covering. Is it not about time, therefore, that some system be devised for accomplishing the same result with respect to gas and water pipes? The difficulties, or rather the expense, will be greater, because these conductors are necessarily much larger; in fact, a pipe tunnel seems to be the only solution. Cities to-day are, however, well supplied with drainage sewers, which are, in a sense, tunnels, and it seems that the time is approaching when tunnels for introducing supplies of gas and water into a city will be considered just as necessary as those for disposing of wastes. As the automobile drives out the horse from city streets the problem will become more important, as the latter vehicles are not so destructive of the pavements as are animals. More attention will then be given not only to keeping the street surface in perfect condition, but also to keeping it clean.

CONTINUOUS-CURRENT ARMATURE WINDING DIAGRAMS—II.

BY H. M. HOBART.

TWO-CIRCUIT WINDINGS.

The reader will have noticed that in multiple-circuit windings, successive conductors (following the winding connections) lie under poles of opposite polarity. Thus in the first winding considered (Figs. 1-11[1]), the connection was from conductor No. 1 over the back end to No. 50, then over the front end to No. 3. If conductor No. 1 lies under a North pole, conductor No. 50 will lie under a South pole, conductor No. 3 under a North pole, etc. The important requirement is that each successive conductor shall lie under a pole of opposite polarity. This, it is evident, could be accomplished by the arrangement shown in the lower half of Fig. 15 just as well as by the arrangement shown above it. The former plan is employed in the so-called two-circuit windings, the latter in the multiple-circuit windings. Fundamentally, therefore, the windings may be identified by these characteristics (at any rate, in the case of windings with one turn per segment); it will be fairly readily seen,

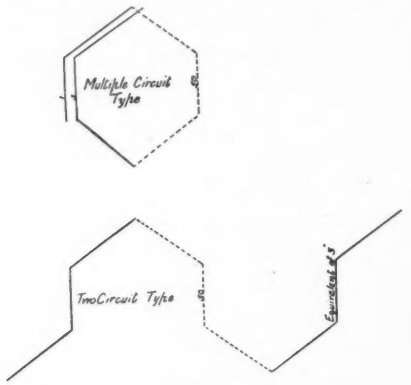


FIG. 15.—ELEMENTS OF MULTIPLE-CIRCUIT AND TWO-CIRCUIT WINDINGS.

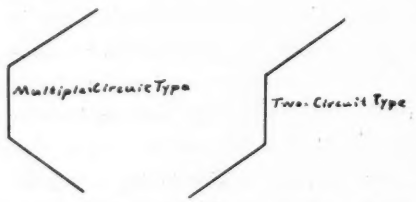


FIG. 16.—LINE REPRESENTATIONS OF MULTIPLE-CIRCUIT AND TWO-CIRCUIT WINDINGS.

from an inspection of an armature, that the connections at the front and back ends of a multiple-circuit winding are in the same direction when any particular conductor is considered, as seen in the left-hand diagram of Fig. 16, and in opposite directions in the case of two-circuit windings, as seen in the right-hand diagram of Fig. 16. The conductors designated respectively 3 and "equivalent of 3" in Fig. 15 are evidently at all times situated in fields of polarity opposite to the fields in which conductor No. 50 may be situated.

In Figs. 17 and 18 are shown, side by side, reproductions of photographs of windings of these two types, and in which these characteristics are seen at a glance.

In Fig. 19 is given the diagram of a two-circuit winding developed by the actual method applied in Fig. 14[1] to a multiple-circuit winding.

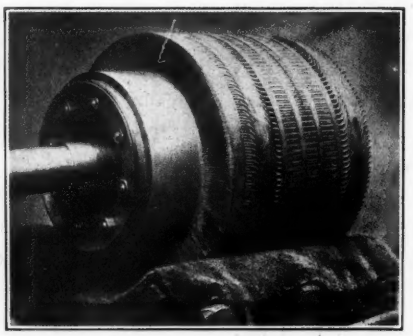


FIG. 17.—COMPLETED LAP-WOUND (MULTIPLE-CIRCUIT) ARMATURE.

It would be out of place in the present article to enter upon the theory of these two types of winding, as this is a subject which can only concern those individuals whose duty it is to carry out the electro-

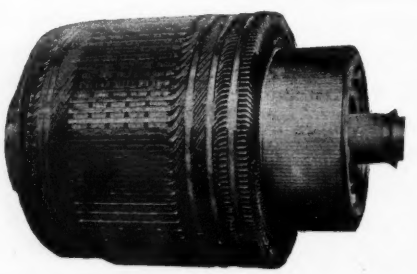


FIG. 18.—COMPLETED WAVE-WOUND (TWO-CIRCUIT) ARMATURE.

magnetic pre-calculations. Suffice it to point out here that for a given number of face conductors and poles, a given magnetic flux from each pole, and a given speed, a multiple-circuit armature will have a lower voltage at the commutator than will a two-circuit armature. If it is a four-pole machine, the multiple-circuit armature will have 2/4, *i. e.*, 1/2 the voltage; if a six-pole machine, 2/6, *i. e.*, 1/3 the voltage, etc. But it will make up in current capacity that which it loses in pressure. Thus, suppose that two six-pole armatures have the same number and size of conductors, and that the magnetic flux and the speed are the same in both cases. Suppose the multiple-circuit armature, for a given heating, gives 600 amperes at 200 volts; then the two-circuit armature will give 200 amperes at 600 volts.

In everything that has been said, a two-circuit *simplex* winding has been assumed. There is, however, another large class of two-circuit windings, which may be designated two-circuit multiplex windings. Thus we may have two-circuit duplex, two-circuit triplex windings, etc., but these are not often employed and unless expressly stated to the contrary, it may be understood that a two-circuit single winding is meant.

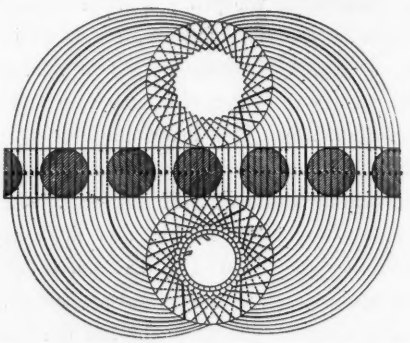


FIG. 19.—DEVELOPED WINDING DIAGRAM FOR TWO-CIRCUIT, SIX-POLE ARMATURE. SIXTY-TWO CONDUCTORS. $Y_f=9$. $Y_b=11$.

Multiple-circuit windings are sometimes called "lap" windings and two-circuit windings are sometimes called "wave" windings. These two names have been suggested by the characteristics illustrated in Fig. 15. "Wave" windings (*i. e.*, "two-circuit" windings), are often employed in machines of small capacity, and are also useful for intermediate capacities where the speed is low. They are characterized by having two circuits through the armature from positive to negative brushes, no matter how many poles there are. Each of the two circuits carries one-half of the

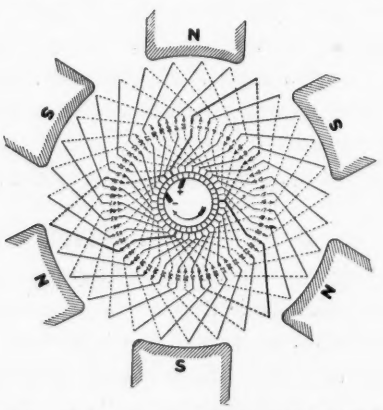


FIG. 20.—CONVENTIONAL DIAGRAM OF SIX-POLE, SIXTY-TWO CONDUCTOR, TWO-CIRCUIT WINDING.

[1] ELECTRICAL REVIEW, March 30.

[1] ELECTRICAL REVIEW, March 30.

total current. The "lap" (*i. e.*, "multiple-circuit") winding is more suitable for large machines, and is also required in machines of intermediate capacity where the speed is high. It is characterized by having as many circuits through the armature from positive to negative brushes as the machine has poles, the current, of course, dividing equally among all these parallel circuits. Thus in a 1,600-ampere sixteen-pole machine with a multiple-circuit winding, each circuit would carry $\frac{1,600}{16} = 100$ amperes.

Thus, instead of comparing, as in a preceding paragraph, two armatures with the same number of conductors connected respectively as two-circuit and as multiple-circuit windings, we may also instructively compare two armatures for the same current and voltage, but wound respectively with these two types of winding. If the machine has four poles, then such a comparative study will show that the two-circuit winding has half as many conductors and that each conductor is of twice the section, since it must carry half the total current, whereas each conductor of the multiple-circuit winding will only have to carry one-fourth of the total current.

If the comparison is for a six-pole armature, the two-circuit winding will have but one-third as many conductors and each conductor will have three times the section. It is thought that these brief statements may be useful as illustrating the general fact that two-circuit windings tend toward requiring fewer and larger conductors as compared with multiple-circuit windings. This is often an attractive property from the point of view of the mechanical construction, and advantage may well be taken of it in small and moderate-sized designs, but in large, multipolar generators, the best results will generally be obtained by means of multiple-circuit windings.

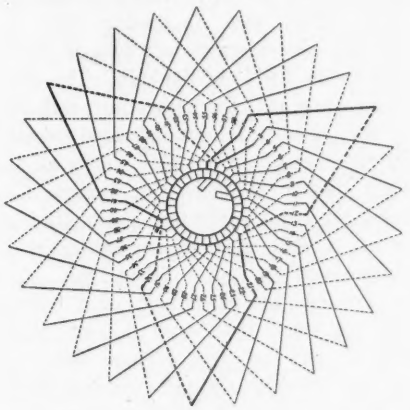


FIG. 21.—TWO-CIRCUIT WINDING FOR SIX-POLE MACHINE. N=6. C=58. Y_f=9. Y_b=11.

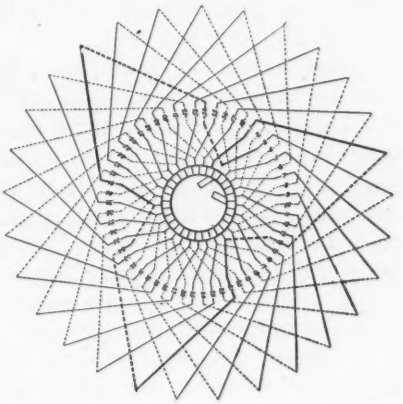


FIG. 22.—TWO-CIRCUIT WINDING FOR SIX-POLE MACHINE. N=6. C=58. Y_f=7. Y_b=13.

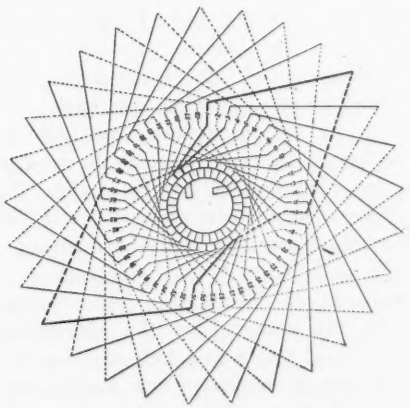


FIG. 23.—TWO-CIRCUIT WINDING FOR SIX-POLE MACHINE. N=4. C=58. Y_f=15. Y_b=15.

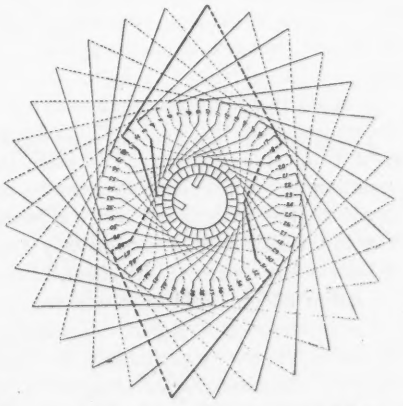


FIG. 24.—TWO-CIRCUIT WINDING FOR SIX-POLE MACHINE. N=4. C=58. Y_f=13. Y_b=17.

In selecting the precise number of conductors for two-circuit windings, and in interconnecting them, one must conform to the requirements of the formula

$$C = n\,y \pm 2$$

in which

C = number of face conductors.
n = number of poles.
y = winding pitch.

If y (the mean pitch) is an odd number, it may be taken at the same value at both back and front ends, *i. e.*, y (mean) may equal both y_b and y_f. Herein is another, although minor, point of difference from multiple-circuit windings. If, in multiple-circuit windings, y is an even number, y_b and y_f must be respectively 1 greater and 1 less (or *vice versa*) than the mean value of y; or the back and front pitches may be 3 greater and 3 less, or 5 greater and 5 less, etc. These pitches will, however, generally be taken 1 greater and 1 less. It will be shown at a later stage, under what conditions it becomes of advantage to take y_b and y_f 3, 5, etc., greater and less than the mean pitch. In Fig. 19 the mean pitch is 10 ($y = 10$); the back pitch, y_b is equal to 9 and the front pitch, y_f to 11. The winding of Fig. 19 is again shown in Fig. 20 arranged according to the more usual and convenient conventions. An element of the winding is heavily lined in, in order to again impress upon the reader this distinguishing characteristic of a two-circuit winding. It will be noticed in Fig. 20 that only two sets of brushes are indicated although the machine has six poles. For two-circuit windings, two brushes suffice, independently of the number of poles, but as many sets of brushes as there are poles are generally preferable. For multiple-circuit windings there must be as many sets of brushes as there are poles, the only alternative consisting in cross-connecting the commutator, a very undesirable practice, now generally abandoned.

Let us construct a six-pole, two-circuit winding diagram with 58 conductors. We have $n = 6$, $C = 58$.

$$C = n\,y \pm 2,$$
$$58 = 6\,y \pm 2,$$
$$6\,y = 60 \text{ or } 56.$$

As 56 is not divisible by 6, we find that the only value for the mean pitch is

$$y = \frac{60}{6} = 10.$$

Let $y_b = 11$ and $y_f = 9$. The diagram is given in Fig. 21.

Suppose with the same value for the mean pitch, *i. e.*, $y = 10$, we had taken $y_b = y + 3$ (instead of $y + 1$) $= 10 + 3 = 13$ and $y_f = y - 3$ (instead of $y - 1$) $= 10 - 3 = 7$, then the diagram becomes that shown in Fig. 22.

We may also take this same number of face conductors, *i. e.*, 58 and construct four-pole windings. For these cases,

$n = 4$ and our formula becomes

$$58 = 4y \pm 2$$

$$y = \frac{60 \text{ or } 56}{4} = 15 \text{ or } 14$$

Let us take the solution which gives

$$y = 15.$$

Then we may take

$y_b = 15$ and $y_f = 15$ (Fig. 23)

or

$y_b = 17$ and $y_f = 13$ (Fig. 24),

as both of these comply with our formula which merely requires that y (mean) shall be equal to 15.

The use of such a small number of conductors, while it aids in the study of windings, is in some respects very misleading. Thus with the far larger numbers of conductors generally occurring in actual practice, these differences in the choice of pitch have a far smaller *percentage* effect on the winding, and hence may be employed when useful purposes are thereby served, which is occasionally the case.

(To be concluded.)

Meeting of the Association of Electric Lighting Engineers of New England.

At the fifth annual meeting of the Association of Electric Lighting Engineers of New England, held on March 20, at Boston, Mass., the following-named officers were chosen: president, W. S. Mulligan, Springfield; vice-president, A. H. Kimball, Fitchburg; secretary and treasurer, P. C. Brown, Boston; executive committee, J. C. Norcross, Hudson; S. F. Smith, Salem; W. P. Hazeltine, Lynn; A. E. Bliss, Malden; G. E. Crosby, Boston, and C. H. Miles, of Lexington.

The papers read were of unusual interest and of special value to men engaged in furnishing illumination or power, either by electricity or gas. "Automobiles in Central Station Practice," by D. F. Burritt, of Springfield, was chiefly a plea for the installation of motor cars in substitution for horse vehicles. The writer claimed that efficiency and economy would thus be secured. "High-Efficiency Units," by S. E. Doane, dealt in part with the possibilities of increased candle-power and daylight quality of illuminants. "Employers' Liability; Its Benefits and Cost," was the subject of Mr. Linscott's paper. Professor H. E. Clifford spoke on "The Moore Tube System of Lighting." Then came several papers contributed by the presidents of lighting companies on the desirability of establishing a department for soliciting new business, and the comments in still another paper of managers and solicitors for lighting companies on the same subject.

AN EXPLANATION OF THE SHORT LIFE OF FROSTED LAMPS.[1]

BY EDWARD P. HYDE.

It has long been recognized that the useful life of a frosted incandescent lamp, taken to eighty per cent of its initial candle-power, is only a little more than one-half the life of a corresponding plain bulb lamp. The only explanation which has been advanced, so far as the writer knows, is that the temperature of the frosted lamp is higher, due to the increased absorption by the bulb, and that therefore the lamp reaches any given point in its life, *e. g.*, the eighty per cent point, in a shorter time than that required for the corresponding plain bulb lamp.

Without entering, at present, into a discussion of the possible temperature effects, it is sufficient to notice that if the shortened useful life can be attributed to this cause, it is very probable that, due to the same cause, the total life of a frosted lamp up to the time when the filament burns out, would also be very much less than that for the plain lamp. On the contrary, the writer has recently been informed by S. E. Doane, chief engineer of the National Electric Lamp Association, that numerous tests made at the engineering laboratories of the association indicate that if the life is taken to the time when the filament burns out, the average life of frosted lamps is the same as that for plain lamps.

It would therefore seem that some other explanation than that of the effect of temperature must be sought. A possible explanation of the phenomenon recently occurred to the writer, and was subjected to a test which showed conclusively that at least a large part of the effect, if not the entire effect, could be accounted for by the proposed explanation. A complete discussion of the investigation with the detailed numerical results obtained is to be published shortly in an extended paper on spherical reduction factors and on the effect produced by plain and frosted bulbs of various shapes on the distribution of light around filaments of different forms. It was thought desirable, however, on account of the general interest in the question of the short useful life of frosted lamps, to publish this preliminary note outlining the explanation of the effect.

If we consider the case of a new plain bulb lamp, a certain small percentage of the total flux of light emitted by the incandescent filament is absorbed by the glass envelope surrounding the filament. When the lamp is frosted a relatively large part of the light which in the plain bulb would pass through the outer surface of the bulb is diffusely reflected back through the glass. In this way a relatively large part of the total flux of light passes through the glass more than once, and so the frosted bulbs show an absorption about five per cent greater than that for the plain bulbs.

Now, the actual absorption coefficient of glass is quite small, so that it is readily seen that if in any way the absorption coefficient is increased appreciably, the apparent absorption due to frosting would be increased greatly. This is what happens when with increasing life the strongly absorbing carbon film is deposited on the inside of the bulb. The effect is the same as if the absorption coefficient of the glass had been increased greatly. In the case of an old plain lamp all the light passes through the carbon film once, the small percentage passes through twice, a still smaller percentage three times, and so on. When the lamp is frosted the percentage that passes through more than once is very much larger, and so the carbon film has an opportunity to absorb a much larger percentage of the total flux. According to this theory, although at any time the filament in the frosted bulb may be emitting the same total flux of light as that emitted by the filament in the plain bulb, the absorption of light in the carbon film is much greater in the one case than in the other, and so the apparent intensity of the frosted lamp at any time during life is less than that of the plain lamp, the difference in intensity increasing with the number of hours the lamps have burned.

In order to test the hypothesis in a rough way a frosted spherical diffusing globe was mounted on the photometer bench. At first a new four-candle-power lamp whose intensity was known was placed inside the globe, and the apparent absorption of the globe was measured. Then an old four-candle-power lamp on the inside of whose bulb a very perceptible deposit of carbon had formed was substituted for the new lamp. Measurements on this lamp showed a much larger apparent absorption of the frosted globe. Then the new lamp was coated with a layer of lacquer, which absorbed some of the light, and a third determination of the absorption of the globe was made. As before, the apparent absorption was greater than with the bare lamp.

Although in this way the presence of the effect was plainly noticeable, no quan-

[1] Communication from Bureau of Standards, Washington, D. C.

titative results could be obtained, because the conditions were quite different from those existing when the bulb of the lamp is frosted. On account of the small size of the neck of the diffusing globe compared with the diameter of the globe, the largest lamp that could be used filled only a relatively small part of the inside of the globe, and so of the light diffusely reflected back by the frosted globe only a part passed through the lamp bulb. Therefore the magnitude of the effect measured in this way was necessarily small compared with that which would occur with ordinary frosted lamps.

In order to make a quantitative determination of the effect, ten comparatively new lamps and twelve old lamps that had dropped to eighty per cent in candle-power were carefully measured for mean horizontal and mean spherical candle-power. They were then sent to a lamp factory and frosted by the acid process, care being exercised to see that the frosting was as nearly uniform for the different lamps as it was possible to obtain. The lamps were then returned to the Bureau of Standards and measured. The new lamps were found to have decreased in mean horizontal intensity by about four per cent on the average, the individual lamps agreeing among themselves to within less than two per cent. On the other hand, the older lamps were found to have decreased in mean horizontal intensity by eighteen per cent, or fourteen per cent more than the new lamps. In other words, the apparent absorption of the frosting was approximately four and one-half times as great for the old lamps at the end of their useful life as for the new lamps. This means that if we were to assume no difference in the physical or mechanical properties of plain and frosted lamps, a lot of plain lamps which would decrease twenty per cent in candle-power in a definite number of hours, would in the same number of hours decrease approximately thirty-two per cent if they were first frosted. The useful life of the frosted lamps to eighty per cent of initial candle-power would be about sixty or seventy per cent of the useful life of the plain lamps, a value in approximate agreement with that commonly accepted. This shows that whatever effects may be produced in the lamps by frosting them, the mere absorption by the deposited carbon film, as explained above, is sufficient to account for a decrease in useful life of about thirty or forty per cent.

A single set of measurements of mean spherical intensity indicated that the new lamps had increased about the same in mean spherical candle-power as in mean horizontal, whereas the old lamps had decreased several per cent more in mean spherical intensity. This is probably due to the uneven distribution of the carbon on the inside of the bulb.

The following experiment has been planned to determine whether there are any other elements entering than that of the increased absorption of the carbon film due to internal reflections. A large number of carefully selected lamps will be accurately measured, of which twenty lamps will be burned to the "peak" point in the curve, twenty more to a point corresponding to about sixty per cent of the normal useful life of the lamps and forty more to the end of their useful life, measured to the eighty per cent point. Twenty lamps will not be burned at all. All of the lamps, except twenty of those at the end of their useful life, will now be frosted at the same time and by the same process, and then all will be burned until the filaments break. In this way different points in the life curve can be reached by different paths. Thus, for example, it will be interesting to note whether the twenty lamps frosted at the end of their useful life will have the same average value as the twenty lamps frosted initially and then burned for a number of hours corresponding to the average useful life of the plain lamps. In this way it is hoped to determine whether any other elements enter to partly account for the relatively short useful life of frosted lamps.

The Dolter Surface-Contact System.

A surface-contact system of the Lorain type has been in operation at Wolverhampton, England, for five years. More recently another system was installed at Lincoln, and it is reported to be operating successfully. The latest development in this field has been the installation of three systems at Torquay, Mexborough and Hastings. The type of system adopted for these new roads is that known as the Dolter, which has been used for some time on the Continent. While no essential change has been made, there have been some changes in details which are thought to simplify the apparatus and render it more reliable. The system, as used in Paris, consists of a feeder laid in a shallow trench between the running rails and surrounded by bitumen. This is fed by other feeders laid in pipes on the solid system along the side of the street. At intervals of nine feet along the track, midway between the rails, are placed the contact studs and boxes. A contact piece in the lower part of each box is connected permanently to the central conductor. The box itself contains a heavy bell-crank lever hinged and mounted so that it normally falls by gravity, opening the circuit. When the upper arm of the lever is attracted upward the circuit is closed by means of a carbon block on the lower arm brought in contact with a second carbon block connected with the stud which projects above the pavement. This action is effected by means of a long double iron skate or runner suspended below the car so that it just touches the surface of the contact studs. This skate is magnetized by three or more electromagnets taking current from the working conductor. A small storage battery is also provided for starting the car in the first instance. This is automatically charged when the car is in operation. As a safeguard, a second small skate follows the first, and connects the stud to the rail, so that in case the bell crank fails to open the circuit, this connection short-circuits the stud and opens a fuse contained within the box. The stud then remains dead until another fuse is put in place. As the skate spans two studs, this action will not put the road out of service until two or more consecutive studs are dead. The contact skate is divided into sections and joined by flexible metallic bands, so that it may adapt itself to curves. The current passes from the skate around the field coils of the electromagnets, thence to the car controller and motors, and so to the rail. The English system differs from the others principally in improvements of the stud and in the method of magnetizing it. The stud consists of a manganese steel outer chair nine and one-half inches by five and one-half inches, into which is fitted a manganese steel top plate. The latter carries two small studs of magnetic steel, the manganese steel being itself non-magnetic. The studs are also somewhat heavier than those in Paris, in order that they may withstand the heavy traffic. The stud is dove-tailed into the steel top and rigidly bolted to the steel chair. Beneath the manganese steel plate is a gun-metal casting, to which is attached a strong pot of insulating material. This is three inches in diameter and seven inches deep. Within this is suspended the bell crank and the fixed contact, the former being hinged from the gun-metal casing. The magnetic circuit is completed through the two steel plugs on the stud. The contact piece on the lever is copper. At the bottom of the pot is an ordinary cable clip, through which the feeding cable passes. The latter is not carried into the box. Bitumen is poured around the clip and cable, completely insulating them. The cup is filled with a heavy insulating oil, which prevents arcing. The contact studs and pots can readily be lifted out for examination and adjustment. The total length of line at Torquay is eight miles, mostly single track. The Mexborough system is seven miles in length, also mostly single track. The Hastings system is about one and one-half miles long. —*Abstracted from the Tramway and Railway World (London), March 7.*

Electric Railway Engineering Preliminaries—Part III.[1]

By Sydney W. Ashe.

ROTARY-CONVERTER SUBSTATIONS.

ROTARY-CONVERTER substation practice has, at the present day, been fairly well standardized. The general dimensions of a substation building vary with the amount of apparatus to be accommodated. This apparatus usually consists of converters, oil switches, transformers, operating switchboard, high-tension bus, general distributing board, control board, cranes, protective devices, instruments, transformer blowers with motors, local storage batteries for the operation of switches, relays, signal lamps, etc., motor-generator battery sets and starting sets where employed. These pieces of apparatus bear a definite relation to each other, as will be discussed later under the head of circuits.

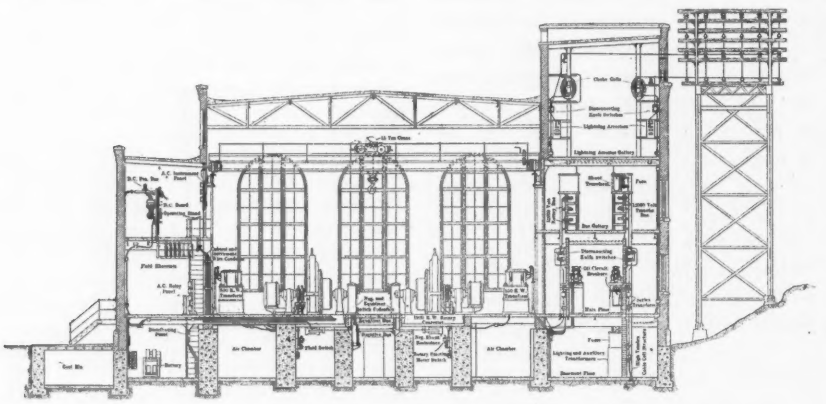


FIG. 1.—ELEVATION OF WOODHAVEN JUNCTION SUBSTATION OF LONG ISLAND RAILROAD.

In order to reduce to a minimum the expense of wiring, and also to economize space and produce a symmetrical station, the converters are arranged in rows, near which are placed the transformers. Where the station load is heavy, two rows of converters facing each other are employed. The switch gear in some cases is located in galleries, while in other cases it is located on the main floor. The advantages and disadvantages of both cases will be discussed later.

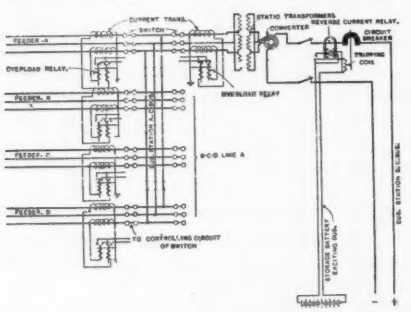


FIG. 2.—MODEL SUBSTATION LAYOUT.

STRUCTURAL FEATURES.

When a site is proposed for a substation, soundings should be made to determine the presence of water, rock and the general character of the soil. Oftentimes this important point is overlooked with sad results. The use of concrete for foundation beds seems to be the approved practice at present. While the foundations are being constructed, concrete pedestals for the converters and for the general support of the framing should be built.

Substation buildings should be built of fireproof materials, such as brick or terra cotta, with firm girder construction. This form of construction is expensive, but it pays in the end. The floors should be of concrete or stone slabs, and the window frames and doors should be of copper sheet properly strengthened and soldered.

Where space is limited and galleries are employed for switchboards the galleries are built at the rear of the station. This is the practice of the Interborough Rapid Transit Company, of New York. On the other hand, the Long Island Railroad Company builds its substations with galleries on the sides.

Care should be taken to see that there is ample ventilation in the substation. The writer has operated switchboards where the temperature was 106 degrees Fahrenheit. Such a condition is unwarranted. It is also a good plan to have a clear space under the converters, so that air can circulate through the windings. Another point is to see that the sewer connection is not too low, so that there will be no possibility of the cellar of the substation becoming flooded and of water passing into the air chambers below the transformers. When this happens there is likelihood of the air from the blowers sending the moisture up into the transformers. Windows should be arranged so that they can be shut quickly in case of rainstorms, to prevent moisture from coming in on the converters.

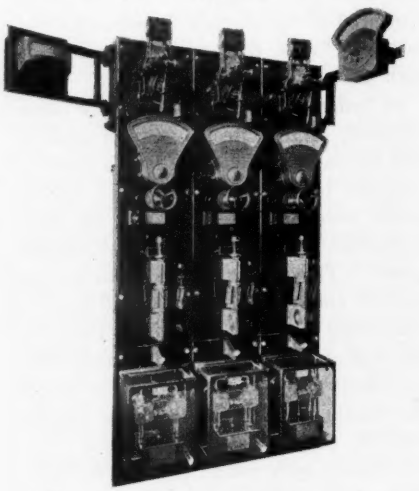


FIG. 3.—FRONT VIEW, DIRECT-CURRENT MACHINE PANELS.

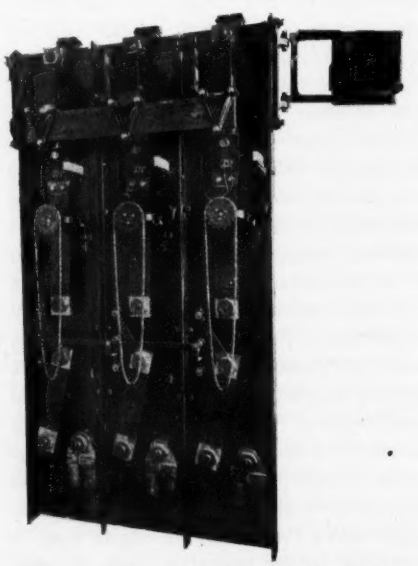


FIG. 4.—REAR VIEW, DIRECT-CURRENT MACHINE PANELS.

It is quite common to see converters mounted with their bed-plates flush with the floor. The metallic surface of the bed-plate thus exposed is covered with rubber mats. It is undesirable to have

[1] For Part I see ELECTRICAL REVIEW, June 2, 1906; for Part II see ELECTRICAL REVIEW, October 13, 1906.

converters set too low in the floor, as it creates a tendency on the part of the rotary tender to shirk cleaning the under brushes. Furthermore, when in this position the converters draw the dirt from the floor into the machine. On the other hand, it is inconvenient to have converters projecting too far out of the floor. With some substations already installed it is necessary for the rotary tender to climb a few steps to reach the upper brushes of the converter. This is not desirable unless the machines are of such large capacity as to make it necessary. For instance, in the new substations of the New York Edison Company this system is used with the 2,000-kilowatt rotaries. Where the frame of the converters projects about eighteen inches out of the floor, the operating results seem to be most satisfactory. This arrangement is not so artistic as with a converter whose frame is flush with the floor, but it is more satisfactory.

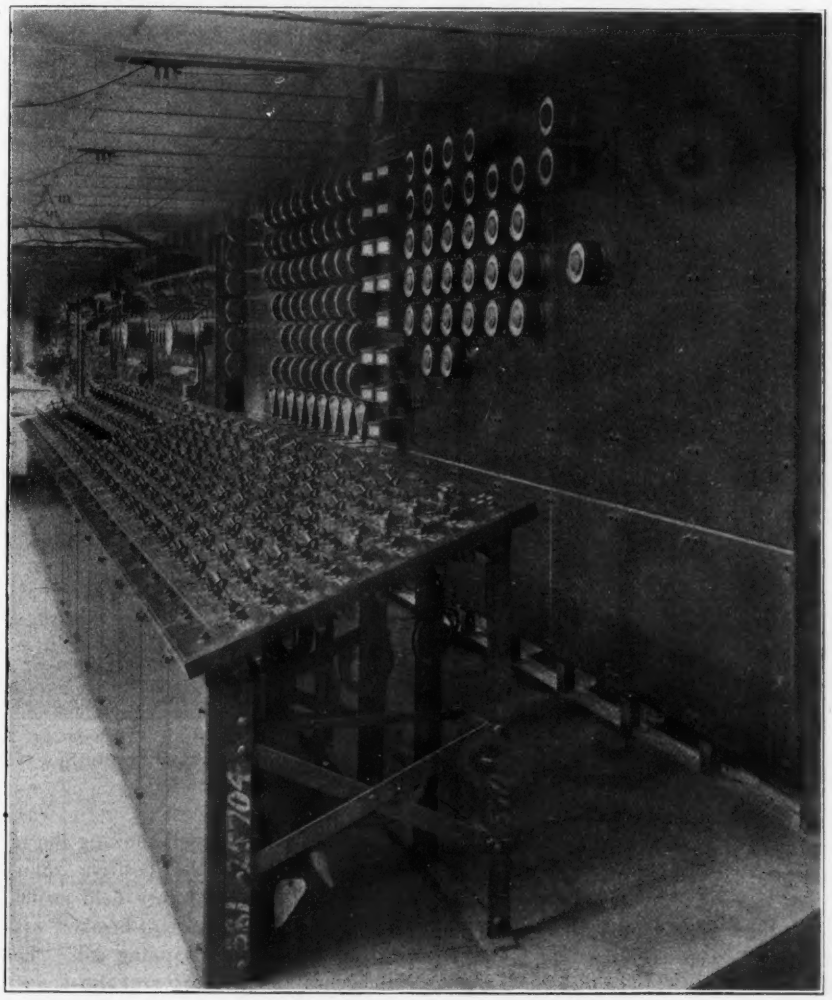


FIG. 5.—MAIN INSTRUMENT AND CONTROLLING BOARD, MAIN STATION, INTERBOROUGH RAPID TRANSIT COMPANY, NEW YORK CITY.

It is not desirable, in the limited space at hand, to enter into a discussion of the architectural features of substation buildings, except in so much as they affect operation. There are many excellent treatises published which give all the essential details on strength of materials, framed structures, foundations, and bearing surfaces of soils, to which the reader is referred. Many of the structural features are obvious, however, from a consideration of existing substations. For instance, Fig. 1 is an elevation of the Woodhaven Junction substation of the Long Island Railroad. From this figure the general arrangement of the foundation is apparent, showing the pedestal support to the walls, partitions and rotary converters. The large windows provide excellent lighting and ventilation. The wiring circuits, as they enter the building from the pole line to the lightning arresters, high-tension switches, high-tension bus, etc., are also plainly evident. This arrangement of substation interior consists of three parts, the main room containing the converters with starting motors and transformers, the high-tension galleries for lightning arresters, high-tension bus and oil switches, and the galleries containing the instrument board and direct-current distributing panels. This arrangement separates as much as possible the direct-current side of the system from the alternating-current side. The direct-current positive bus with feeder switches is located in the direct-current operating gallery, and the negative bus is located in the cellar near the converters and the negative feeder ducts.

Before discussing the advantages and the disadvantages of various arrangements of substation equipment, it is perhaps desirable to trace out the electrical circuits and show the relation which the various pieces of apparatus bear to each other. As an example, the case of a substation fed with high-tension current at 11,000 volts, three-phase, twenty-five cycles through underground cables, is cited. The converters in this substation are started from the direct-current side from a starting set. As the system is underground, lightning arresters are dispensed with.

SUBSTATION CIRCUITS.

There are usually three distinct circuits to be considered in a substation layout—the incoming high-tension feeders conveying alternating current, the outgoing feeders carrying low-tension direct current, and the local storage-battery circuit for the operation of relays, signal lamps, oil switches and similar auxiliary devices. There are also auxiliary circuits in the station for the operation of lights, cranes, motors, etc. Fig. 2 is a wiring diagram in elementary form of a model substation layout. This represents General Electric Company practice. Owing to simplicity, ease of handling and other economic conditions, three-phase transmission is rapidly becoming standard for interurban practice. This description will therefore confine itself to that sphere.

With underground systems current usually enters the substation through high-tension lead-sheathed cables terminating in a bell, in which are connected the house feeders. This bell is filled with an insulating compound to keep all moisture from entering between the end of the lead sheathing and the cables proper. Where overhead cables are used for transmission, it is necessary to bring the high-tension feeders in through the upper side walls and connect in lightning arresters (see Fig. 1). The house feed-

ers go direct to oil switches (Fig. 2), passing through these to a high-tension bus (see Fig. 2). Several high-tension feeders may thus be connected in multiple to the same bus, each feeder being protected by an oil switch. These switches are equipped with time-limit overload relays, which open the switches when a severe overload has been upon the feeders for a predetermined number of seconds. From the high-tension bus, feeders pass through single-pole switches to the transformer oil switches. These switches are likewise protected with time-limit overload relays. From the oil switches the feeders pass to the high-tension side of step-down transformers, the low-tension sides of which are connected directly to the brush-holders of the rotaries. In case of accident to the synchronizing apparatus, it is sometimes desirable to insert single-pole switches in the circuit at this point, one in each phase. The converters may then be synchronized with a bank of lamps. By means of the transformer oil switches it is possible to control independently each rotary circuit. When machines are synchronized from the high-tension side, these switches are closed at the instant of synchronism. Considering the low-tension side of a rotary, the negative armature terminal and the negative field terminal are tied together and grounded to the ground bus through a single-pole switch. Where rotaries are compounded, an additional switch is provided for connecting the compound coils of the rotary in multiple with the coils of the other rotaries. An equalizer bus is provided for this purpose. The positive armature and field terminals are carried to the operating board (Figs. 3 and 4).

Here it is possible to connect the positive feeder to the positive bus through the medium of a circuit-breaker and a single-pole switch. The circuit-breaker is provided with an overload relay and a reverse-current relay. The overload relay should be blocked where an oil switch is used on the alternating-current side of the rotary, providing the oil switch is equipped with a time-limit overload coil. The function of the reverse-current relay is to trip the breaker if the voltage of the rotary should become slightly lower than the bus, a sudden rush of current taking place tending to run the rotary as a motor. These relays trip supposedly at about fifteen per cent of the normal full-load reverse current of the rotary. They are usually set, however, about twenty-five per cent of full load in practice, as they would otherwise be too sensitive.

From the direct-current bus the current passes through a circuit-breaker and a single-pole switch to the rail feeder, passing out of the station to the individual third-rail or trolley sections. The feeder circuit-breakers are protected with straight overload relays. With this arrangement it is possible for an excessive overload or a short circuit to occur on an individual rail section, opening the feeder-breaker and taking the power off that section without interfering with the operation of the rotaries. Sometimes, however, the short circuit or overload is so great as to open the oil switches on the rotary, throwing the machine out of step.

The positive field switch of the rotary is arranged on the switchboard panel (see Figs. 3 and 4), so that when the field has been properly built up and the rotary is operating at about normal speed, the field, if separately excited, may be made self-exciting by throwing this two-way switch over to the positive-rotary armature switch circuit. The stud of the two-way switch is usually connected to the stud of the positive switch.

All of the controlling relays may be operated from a common bench board (see Fig. 5). Usually the negative switches are separated from the positive switches, and have auxiliary apparatus (where provided) separate, so as to be operated by the rotary tender. Indicating instruments and synchronizing mechanisms are also provided. Local battery circuits are arranged for tripping the oil switches, circuit-breakers, etc., as previously mentioned. Fig. 3 is a front view of a direct-current panel, showing the recording wattmeter, the positive rotary armature switch, the rotary field switch, the field rheostat, the circuit-breaker, with overload release and tripping coil. The switchboard instruments are also shown. Fig. 4 is a rear view of the same board, showing the positive bus with special "V"-shaped clamp, ammeter shunts and chains connecting to the spindle of the field rheostats. Rheostats are seldom mounted on the switchboard because of their cumbersomeness and weight and the heat they give off. Fig. 6 shows the front view of the switchboards installed by the Westinghouse Electric and Manufacturing Company in the stations of the Long Island Railroad. Fig. 7 is a rear view of the same board, showing the heavy ammeter shunts and the clamps for the positive bus. A very compact board combining the alternating-current panels with the

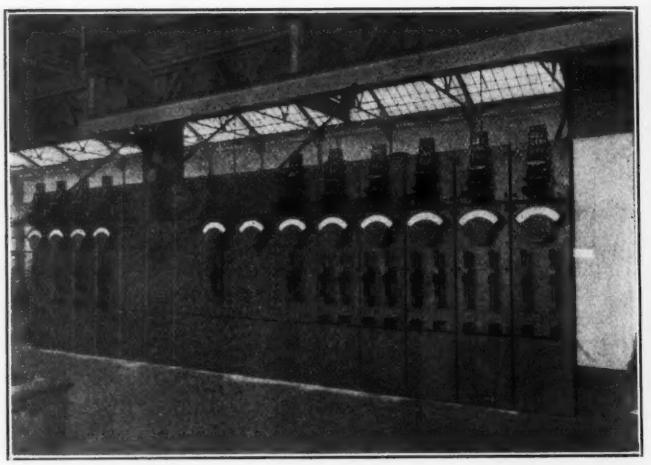


FIG. 6.—FRONT VIEW OF SWITCHBOARD INSTALLED IN THE SUBSTATION OF THE LONG ISLAND RAILROAD.

FIG. 7.—REAR VIEW OF SWITCHBOARD INSTALLED IN THE SUBSTATION OF THE LONG ISLAND RAILROAD.

direct-current panels, in addition to the bench board, is shown in Fig. 8. This board was designed by the General Electric Company for Necaxa, Mexico. It is for fifty-cycle transmission.

FIG. 8.—FIFTY-CYCLE ALTERNATING-CURRENT AND DIRECT-CURRENT CONTROLLING AND INSTRUMENT SWITCHBOARD FOR NECAXA, MEXICO.

ARRANGEMENT OF SWITCH GEAR.

The most suitable arrangement of switch gear is obviously that which best facilitates the manipulation of substation apparatus with a minimum outlay.

There are two distinct arrangements of switch gear, their adoption depending upon the capacity of the substation. With one arrangement, which is especially applicable to small substations, all of the switch gear is located upon the main floor with the converters and with the transformers. The other method, which is usually employed in stations of large capacity, consists in locating all the manually operated switches, except the negative switches, in a switchboard gallery.

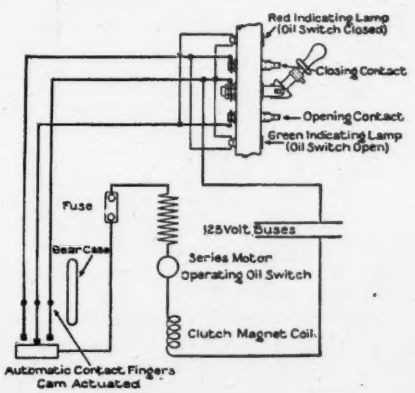


FIG. 9.—OIL-SWITCH CONNECTION.

It is worth noting that in the first case, where all the switching apparatus is located on the same floor with the transforming apparatus, the station attendance is minimized, for the operator may also perform part of the duties of station foreman, and the rotary tender may also perform the duties of janitor, thus dispensing with two men. But this system is not wholly advantageous. In the first place, it is difficult to keep the switch gear clean; and in case of trouble the operator is too near the converters to act with unconcern. On the other hand, this system reduces the expense of wiring to a minimum, allows excellent ventilation and results in a very compact station.

Where a switchboard gallery is employed (Fig. 1), the operator is able at a glance to scan the whole station, a great advantage in case of trouble. He is relieved of the fear of personal injury, he is less hampered and more comfortable, and can better perform his duties. But the expense of wiring is greater and the ventilation inferior.

It is becoming the standard practice to construct the switchboard in three distinct sections; namely, a controller board from which the oil switches are operated, a set of machine panels and a set of distributing panels. The positive direct-current bus-bar forms a connecting link between the machine panels and the distributing panels. This system is modified in small stations.

Various arrangements of circuit-breakers are employed; in some cases they are mounted directly upon the switchboard panels; in others distinct and separate compartments are used. The latter is preferable if the expense be justified, for it disconcerts an operator to see the flash of an opening circuit-breaker.

It has become quite common to separate the negative switches from the positive switches, the reasons for which are evident.

An important feature is the arrangement of a circuit of lamps on the switchboard, and their feeding from the local battery circuit, so that in cases of failure of power at the power-house there may be sufficient illumination in the evenings for the operator to manipulate the board. Upon the same circuit a complete set of signal lamps should be installed to indicate whether switches and circuit-breakers are open or closed.

Switchboards should be built of fireproof materials—preferably of slate free from metallic grains. They should be mounted rigidly in place with angle iron framing and should be built away from the wall a sufficient distance to permit of passage. The cables should approach the board through conduits and should terminate in lugs and be soldered there. Where cables carry heavy currents, the cable connections are liable to heat up if the connections are not properly made, owing to their increased resistance. It should also be borne in mind when running the positive feeders through metal conduits that when grounded the conduits are equivalent to the negative feeders; therefore defects in the cables should be carefully avoided. The National Board of Fire Underwriters' Rules should be closely followed when wiring and erecting switchboards.

LOCAL STORAGE BATTERY FOR STATION USE.

Many large substations are equipped with a set of small storage batteries for the operation of oil switches, reverse-current relays, signal lamps and for energizing the field coils of switchboard instruments. These batteries have a capacity of about thirty ampere-hours and a rated voltage, when charged, of 125. The rea-

son a local battery is employed for such a purpose in preference to the low-tension railway circuits is that in case central station should go out of service, it would be possible to operate the oil switches from the substation. It is true that oil switches could be tripped mechanically, but it would not be desirable, as it would take too much time; and furthermore, to trip the switch the operator would have to leave the operating board. Another reason why storage batteries are used is that the operation of relays and oil switches is affected very materially by a change of voltage. For instance, if the voltage falls the switches fail to operate. This is exceedingly inconvenient when synchronizing, for if the battery switch does not operate it means that the operation of synchronizing must be tried again with another machine. Usually each converter is provided with its individual oil switch. Where railway circuits fluctuate fifty volts or more, the service is not reliable enough to use for switch operation. If, for instance, the voltage were slightly low, the oil switch might close a fraction of a second late, connecting the converter to the circuit out of synchronism, which would cause severe sparking. Where converters are started from the alternating-current side many of these objectionable features disappear, as the converters build up directly into synchronism.

The signal lamps previously referred to require a constant battery discharge of about five amperes in a large station, and the operation of an oil switch takes about twenty-five amperes. These values change slightly, owing to different operating conditions.

The local storage batteries are charged from small motor-generator sets, duplicates of which are installed. When there is any possibility of an oil switch failing to close in time, the operator starts the motor-generator set and charges the batteries. If the oil switch mechanism, which may be magnets or a motor, is connected to the battery circuit while charging, the switch closes properly, as the voltage of the batteries is high. The batteries in this event act as a balancer to the motor-generator set.

When the central station goes out of service the operating mechanisms in the substation can be taken care of easily by the station batteries for about two days. This length of time varies with the number of applications of power.

Associated with all circuit-breakers and oil switches are signal lamps, which are illuminated the instant a switch opens. It is thus possible for the operator to tell immediately by the lights illuminated what circuit has been opened. With the General Electric switchboard colored crystals are arranged to indicate whether an oil switch is opened or closed, a green crystal mounted in the switchboard being illuminated when the switch is open and a red crystal similarly lighting up when a switch is closed. This arrangement of switch gear is illustrated in Fig. 9 for a General Electric oil switch, motor operated. This method is also employed by the Westinghouse Electric and Manufacturing Company, except that the oil switches are solenoid operating. Referring to Fig. 9, when the operating battery switch on the bench board is shut, current passes from the local battery circuit through a small series motor and the clutch magnet coil, operating the switch. By means of contact fingers on the switch the battery circuit is also closed through the signal lamps. The circuits are plainly evident in the figure. The arrangement of signal lamps to indicate whether switches are open or closed is very convenient, as feeder circuit-breakers are usually placed in enclosures of brick or concrete and cased in on three sides. It would therefore otherwise be impossible to tell what circuit-breaker had opened from the middle of the board. A row of five or ten incandescent lamps of sixteen candle-power is usually lighted from this battery also. These lamps are placed over the switchboard, so that in case of failure of power at night the illumination will be sufficient to enable the operator to clear his board. It is always advisable to have two lighted lanterns convenient when operating in the evening.

There is only one objection to the use of lamps to illuminate the switchboard crystals previously referred to. These lamps heat up the slate board and expand the lamp sockets. This requires that the lamps be frequently tightened in their sockets. This, however, is a small matter.

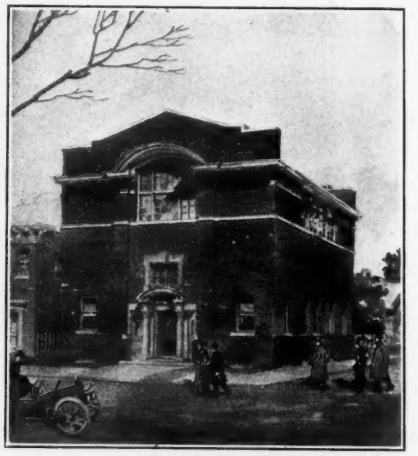
New Electric Works on the Rhine, Germany.

It is reported by United States Consul-General Richard Guenther that two large electric power stations are being erected on the river Rhine, at Augst-Wyhlen, Germany. The output of each of these stations will be about 15,000 horse-power. One of them is located on the Swiss shore, and the other on the German side of the river.

Branch Exchange Telephone Buildings for the Home Telephone Company of Detroit.

The accompanying illustration shows the type of the three branch exchange telephone buildings which the Home Telephone Company, of Detroit, Mich., is building in different parts of the city. The buildings were designed and the work of construction is being superintended by Stratton & Baldwin, architects.

The East exchange is under process of construction at the corner of Sylvester and Field streets. This exchange will serve the eastern part of the city. The West exchange is under construction at the corner of Lafayette and Dragoon streets, and will serve Delray and the western part of the city. The North Woodward district will be served by the



TYPE OF BRANCH EXCHANGE BUILDINGS BEING ERECTED BY HOME TELEPHONE COMPANY, DETROIT, MICH.

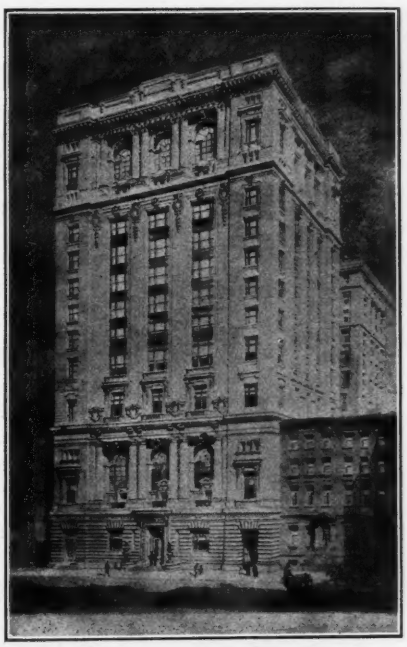
North exchange, which is being built at the corner of John R. and Bethune streets.

These buildings are all about two-thirds completed, and construction is progressing at a satisfactory rate. The material used in the construction is cut stone, terra cotta and dark-red brick. The buildings will be fireproof throughout. A commodious basement will be used for heating appliances and for general storage of telephone supplies. The first story will contain the battery and machine rooms, the managers' and public offices and the rest rooms and lockers for the operators. The second story will be given over entirely to the switchboard, racks, etc. The stairways are so arranged that the upper run lands in the centre of the building. The exchange buildings are so placed on the lot that extensions can be made to the rear of the structures. These buildings, when completed, will house the latest type of multiple lamp line signal central energy switchboards of 7,200-line ultimate capacity, with the necessary outgoing and incoming trunk lines.

The Engineering Societies Building.

The present month will witness the formal dedication of the Engineering Societies Building, which has become possible primarily through the generosity of Andrew Carnegie, although the matter of a single building where the several national engineering societies could combine their influences has been the subject of discussion among engineers for a great many years. In 1895 W. D. Weaver, a member of the American Institute of Electrical Engineers, submitted a plan for a joint home for the several national societies to Andrew Carnegie, receiving from Mr. Carnegie an expression of warm approval. Later, in February, 1903, as one of the contributors to the library fund of the American Institute of Electrical Engineers, Mr. Carnegie was invited to attend its library dinner. This dinner was given on February 9, at Sherry's. The president of the institute told of its growth and the need for a building for the engineering societies. Mr. Carnegie was interested, and spoke of the necessity and advantage of cooperation among engineers. The day after the dinner Mr. Carnegie sent for Charles F. Scott, then president of the American Institute of Electrical Engineers, and Calvin W. Rice, chairman of the Institute building committee, and discussed with them the idea of a permanent home for the united engineering bodies. Following this discussion Mr. Carnegie wrote a memorable memorandum, as follows: "It will give me great pleasure to give, say, $1,000,000 to erect a suitable union building for you all, as the same may be needed." A year later, on March 14, when the plans and estimates showed that a larger sum would probably be required to carry out the idea on an adequate basis, Mr. Carnegie, in a letter addressed to the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers and the Engineers' Club, increased his contribution to $1,500,000, the only limitation on the gift being that it should be devoted to the erection of a building, the societies interested buying the land. As the Engineers' Club had purchased land for a building on Fortieth street, it was decided to erect two separate buildings, one for the club on Fortieth street and one for the three professional societies on Thirty-ninth street, the two buildings to be placed in such relationship that access from one to the other would be easy.

Each of the bodies named in the gift appointed three of its members to form a joint conference committee of twelve, whose duty it should be to accept the gift and erect the buildings. The personnel of this committee follows: American Society of Mechanical Engineers, C. W. Hunt, J. M. Dodge, F. R. Hutton; American Institute of Mining Engineers, A. R. Ledoux, C. Kirchhoff, T. Dwight; American Institute of Electrical Engineers, C. F. Scott, C. W. Rice, T. C. Martin; Engineers' Club, W. H. Fletcher, J. C. Kafer, W. A. Redding. In organizing for its work this body made Mr. Scott chairman, Professor Hutton, secretary, and Mr. Kafer, treasurer. Various changes



THE ENGINEERING SOCIETIES BUILDING, 29–33 WEST THIRTY-NINTH STREET, NEW YORK CITY.

occurred in the personnel of the committee from time to time. Dr. Ledoux was succeeded by E. E. Olcott. Messrs. Rice and Martin were succeeded by Dr. S. S. Wheeler and Bion J. Arnold, and later Dr. Wheeler gave place to John W. Lieb, Jr. Mr. Martin succeeded Mr. Redding, while Mr. Kafer, on his death in 1906, was succeeded by George E. Weed, and Mr. Kirchhoff became treasurer. One of the most important duties of the committee was the division of the gift in proportion to the requirements and objects of the two buildings. This was accomplished by allotting $1,050,000 to the engineering societies building and $450,000 to the club building.

The site acquired for the engineering societies building is on West Thirty-ninth street, north side, between Fifth and Sixth avenues. The frontage covers five city lots, Nos. 29 to 33, the total frontage being 125 feet. This land has been bought with money advanced by Mr. Carnegie, through R. A. Franks, to the three engineering societies, at four per cent interest, the cost being $502,000, one-third of the amount being payable by each society.

The conference committee spent its first year in disposing of the various questions arising in the acquisition of real estate, and secured some twenty-six sets of plans and drawings in a mixed competition of prominent architects. After a careful study of the plans submitted, the firm of Hale & Rogers was appointed architect for the building, assisted by H. G. Morse as associate. The award for the club house was similarly made by the committee to Whitfield & King, of New York.

In order to carry out the affairs of the combined societies a holding corporation was organized. This corporation was formed by a special charter in the state of New York, in May, 1904, and is called the United Engineering Society, acting as trustee for the three founder societies. Its nine trustees are chosen periodically, three each by the councils of the electrical, mechanical and mining engineers. The first president of the United Engineering Society was Dr. A. R. Ledoux, who was succeeded by the present incumbent, E. E. Olcott.

The contract for the construction of the building was executed with Wells Brothers Company on July 17, 1905, and the cornerstone was laid in the eastern wall by Mrs. Carnegie, on May 8, 1906. The entire building, although not quite finished, was ready for use January 1, 1907.

The frontage of the building on West Thirty-ninth street is 115 feet and the depth ninety feet. The building is designed in the French style, and rises thirteen and one-half stories above the sidewalk to a height of 218 feet, six and one-half inches. The exterior is of limestone up to the auditorium floor and of gray mottled brick and terra cotta above.

Access to the building is gained by a central entrance on the street level to the first floor, by the western side door leading to the elevators, and by a broad driveway which encircles it completely, so that carriages can enter by the eastern covered arch, set down their occupants at a side entrance, and emerge by the western gate.

There are three elevators. On each side of the elevator shaft wide stairways rise to the sixth floor of the building, and from this floor another stairway leads directly to the library floor. A freight elevator has been installed on the eastern

side of the building, and a commodious service stairway on the north side rises the entire height of the edifice. At the first floor a rear door communicates with the café of the club house, and on the ninth floor communication is effected with the breakfast room of the club house.

Steam is employed for heating and ventilating purposes, generated at low pressure by three Babcock & Wilcox boilers, the basement being occupied in part by the boiler room. The steam equipment is arranged for high pressure should it, at a later date, be desired to install an electric generating plant.

The heating of the building is accomplished by low-pressure steam circulating through radiators placed underneath the windows.

Pure, fresh air in large quantities is supplied to all the rooms and the main corridors in the lower six floors by means of four motor-driven blowers located in the basement. Air is exhausted from these floors and from the basement throughout the building by means of four motor-driven exhaust fans located in fan houses on the roof. C. & C. electric motors are installed for driving the blowers and exhaust fans.

The electric current for the building is derived from outside street main service furnished by the New York Edison Company and the United Electric Light and Power Company. Both alternating current and direct current are available. The feeder system is subdivided, and the switchboard is designed with meters on each feeder, so as to permit of making charges for electric current for each floor. Separate feeders are provided for the entrance hall and corridors. A control switchboard has been provided for the auditorium. At this point the feeders terminate, and all of the circuits for the auditorium originate and are controlled. At the upper part of the switchboard dimmers are provided for the control of the auditorium lighting. Special feeders and empty conduits are also available for demonstration purposes.

The central space in the entrance hall or foyer is lighted with individual lamps placed in recesses and concealed by panes of ground glass in the ceiling, at the sides of the rectangle formed by the columns around a large central area.

The illumination of the upper floors is unique and decidedly pleasing. Crystal glass balls, holding metallized filament lamps of various sizes, from fifty to 250 watts, are used. In some cases "Pagoda" reflectors are used inside the balls to increase the effective illumination. In the halls above the fourth floor glass globes have been provided to screen the lamps.

The lighting of the auditorium is unique and decidedly effective. A glass septum has been substituted for the usual plaster panels in the ceiling, and the light is transmitted from the individual lamps through this glass shield. Additional lighting, screened by the same kind of glass, is provided at the rear and at the sides of the balcony. Dimmers are provided for reducing the amount of illumination in the auditorium to any desired point.

To prevent the lighting in the assembly and lecture rooms from being distracting or unduly noticeable, the cove method of lighting has been adopted.

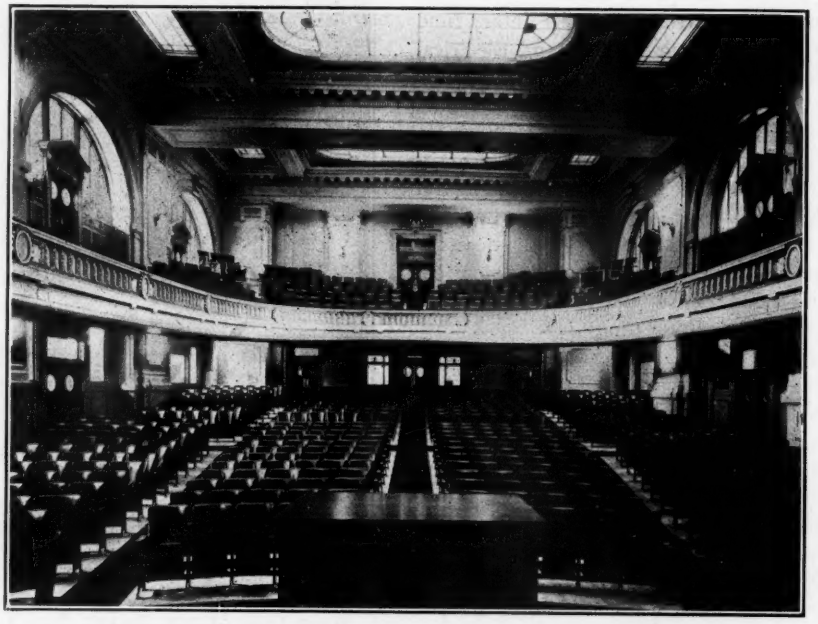
The general illumination of the library is obtained by means of lamps placed above the glass ceiling skylight, on a plan similar to that used in the auditorium. In addition, ceiling outlets are provided for general illumination.

The telephone equipment which has been installed by the New York Telephone Company includes a specially designed single-position switchboard connected to the Bryant central office of the telephone company by means of seven lines. These may be used for incoming and outgoing traffic. There are thirty-eight extension telephones connected to the board, the ultimate capacity being fifteen central office lines and sixty extensions.

The first floor is laid out with continuous marble tile, the central court or main foyer being marked by twelve large columns of Swiss Cipolin marble. A short, low flight of steps leads from the foyer to the elevators. Large chairs and lounges in red leather furnish the foyer. On the foyer walls, facing the main entrance, are two large bronze tablets, one bearing a relief portrait of Mr. Carnegie and the words of his letter, referred to above; and the other a statement to the effect that the land was given by members and friends of the three founder societies.

Immediately above the first floor are the coat room and special toilet facilities.

The main auditorium extends up through two floors, and, with its gallery, will seat about 1,000 persons. On both the parterre and gallery floors, at the sides, the auditorium is surrounded by corridors, rendering access easy to every point. The seats are fixed opera chairs in red leather, with revolvable tops.



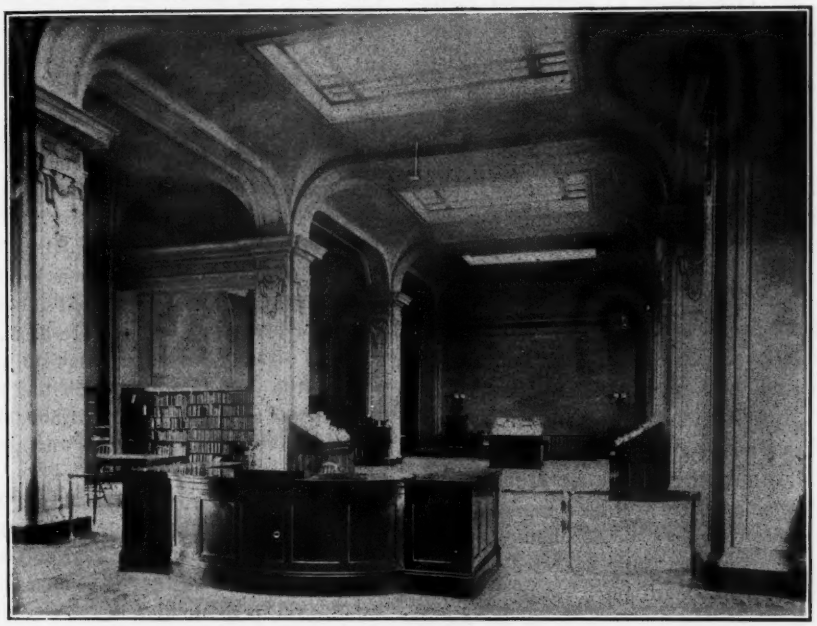
AUDITORIUM FROM SPEAKERS' PLATFORM, ENGINEERING SOCIETIES BUILDING.

The next two floors above the main auditorium are devoted entirely to lecture rooms, of which there are seven. Two assembly rooms, fifty-one by sixty-six feet, and twenty-nine feet by sixty-six feet, respectively, occupy the larger part of the fifth floor, in such a manner that they can be used independently or one may be auxiliary to the other. Two smaller rooms on this floor, sixteen by twenty-two feet, and eighteen by nineteen feet, can also be used separately or as annexes.

The sixth floor is also divided into lecture rooms of smaller dimensions.

The seventh and eighth floors of the building have been reserved for the associate societies that have engineering or

some department of science as their principal object. For these organizations the building affords office areas of varying size, from one room up. Among these societies may be enumerated the Society of



View in Library, Engineering Societies Building.

Naval Architects and Marine Engineers, the Society of Heating and Ventilating Engineers, the National Electric Light Association, the Society of Chemical En-

View in Library, Engineering Societies Building.

gineers, the New York Electrical Society, the Association of Edison Illuminating Companies and the American Street and Interurban Railway Association.

Each of the three founder societies occupies a floor laid out in accordance with its own plans. The mining engineers have the ninth floor, the electrical engineers the tenth floor and the mechanical engineers the eleventh floor. These offices are devoted to administrative and executive work, and the libraries of the three societies have been concentrated in the top floors of the building. The twelfth floor, below the library proper, has been devoted to the book stacks, but at the present time the main library is also equipped with one tier of stacks, with provision for a gallery tier later. Provision is being made for special research accommodation, working alcoves, photographic reproduction, drawing and similar library work.

A bronze bust of Mr. Carnegie, executed especially for the building by Mrs. E. Cadwalader Guild, and presented by the present and past officers of the founder societies, stands at the eastern end of the library, facing the main entrance from the elevators.

The following is a list of the contractors, etc., employed in the construction of the building: general contractor, Wells Brothers Company; heating and ventilating, G. A. Suter & Company; electrical work, Western Electric Company; fixtures, Mitchell Vance Company; plumbing, James McCullagh; furniture and carpets, W. & J. Sloane; shades, Simpson-Crawford Company; library furniture, Library Bureau; book stacks, Art Metal Construction Company; auditorium chairs, American Seating Company; lecture room chairs, Readsboro Chair Manufacturing Company; demonstration tables, L. E. Knott Apparatus Company; stereopticon, Charles Beseler Company; stereopticon screen, Journeay & Burnham; bronze tablets, J. Massey Rhind, sculptor, and the Roman Bronze Company; steam table, Bramhall Deane Company. The following is a list of the sub-contractors, etc.: elevators, Otis Elevator Company; electric pumps, Worthington Pump Company; mill work, Batavia and New York Woodworking Company; ornamental iron and bronze work, Winslow Brothers Company; decorations and general painting, W. P. Nelson Company; special metal doors, Dahlstrom Door Company, New York Central Metal Company and Van Kannel Revolving Door Company; ornamental stucco work and plastering, McNulty Brothers; marble and mosaic work, Empire City Marble Company; ornamental brick, Fiske & Company; granite work, Webb Pink Granite Company; tile wainscoting, Frank L. Davis; coffer and roofing work, James White Company; weather strips, Noiseless and Draughtless Door and Window Cushion Company; leather-covered doors, Frank Fetzer; filters, Roberts Manufacturing Company; fireproof windows, Manhattan Fireproof Door Company; fireproof doors, Howells & Lawrence; ornamental terra cotta, Conkling-Armstrong Terra Cotta Company and R. Guastavina Company; window and door glass, Benjamin Griffen and Pittsburg Plate Glass Company; metal latch and furring, A. Oliver & Company; ornamental stone work, James Gillies & Sons;

parquette floors, J. B. Shaw & Company; finishing hardware, Yale & Towne Manufacturing Company; fireproof floors, National Fireproofing Company; plumbing fixtures, Henry Huber & Company; mail chutes, Cutler Manufacturing Company.

The following programme has been announced:

TUESDAY, APRIL 16—3 P. M.

(1) Music.

(2) Opening—Charles Wallace Hunt, presiding officer. The first use as a gavel of the setting maul employed by Mrs. Carnegie in laying the cornerstone of the building.

(3) Prayer by the Rev. Edward Everett Hale, chaplain United States Senate.

(4) Communications from the President of the United States, President of the Republic of Mexico, and Governor-General of Canada.

(5) Historical address by Charles F. Scott, chairman of the Conference and Building committees.

(6) Acceptance of the building by E. E. Olcott, president of the United Engineering Society, representing the Founder Societies.

(7) Address by Andrew Carnegie, the donor of the building.

(8) Music.

(9) Oration by President Arthur T. Hadley, of Yale University, "The Professional Ideals of the Twentieth Century."

(10) Music.

EVENING EXERCISES, 9 P. M.

9 P. M.-10.30 P. M., general reception in the main auditorium.

10.30-12, reception by the officers and councils of the Founder Societies in their respective headquarters.

Refreshments will be served during the evening on the fifth floor.

It is believed that the associated societies may also hold receptions in their respective headquarters during the evening. There will be music on two or more floors throughout the evening.

WEDNESDAY, APRIL 17, 2.30 P. M.

(1) Introduction by J. W. Lieb, Jr., chairman of the Dedication Committee.

(2) Addresses by presidents of Founder Societies: Dr. Samuel Sheldon, president, American Institute of Electrical Engineers; Dr. F. R. Hutton, president, American Society of Mechanical Engineers; Dr. John Hays Hammond, president, American Institute of Mechanical Engineers.

(3) Greetings and felicitations from foreign and national scientific societies and institutions of learning.

(4) Address by Dr. James Douglas, past-president, American Institute of Mechanical Engineers.

(5) Presentation of John Fritz gold medal to Dr. Alexander Graham Bell.

(6) Presentation of medals for distinguished services to R. W. Pope, secretary, American Institute of Electrical Engineers; Dr. F. R. Hutton, past-secretary, American Society of Mechanical Engineers; Dr. Rossiter W. Raymond, secretary, American Institute of Mechanical Engineers. (By Dr. A. R. Ledoux, past-president, United Engineering Society).

THURSDAY, APRIL 18.

In the afternoon there will be a session of the American Institute of Mining Engineers. A paper entitled "Mining Engineering in New York City," describing the excavation and tunnel work now being carried on by the Pennsylvania Railroad, will be presented by H. T. Hildage. In the evening there will be a session of the American Society of Mechanical Engineers, an address being delivered by Brigadier-General William Crozier, entitled "The Ordnance Department as an Engineering Organization."

FRIDAY, APRIL 19.

In the afternoon there will be a session of the American Institute of Mining Engineers, the details of which will be presented later. In the evening there will be an informal smoker for members of all the societies.

The Technical Publicity Association.

The subject of "House Organs" for manufacturing concerns was discussed at the regular monthly meeting and dinner of the Technical Publicity Association, Thursday evening, March 28. Addresses were made by Stuart Benson, of the R. Wallace & Sons Manufacturing Company; David Gibson, of the Globe Machine and Stamping Company; Henry M. Cleaver, of the Niles-Bement-Pond Company; H. L. Myers, of the New York Leather Belting Company, and W. G. Snow, of the Meriden Britannia Company.

The next meeting will be the closed annual meeting, at the rooms of the Aldine Association, New York city, April 18.

Magnetic Club Anniversary.

The spring meeting of the Magnetic Club will be held at the St. Denis Hotel, Broadway and Eleventh street, New York city, Wednesday evening, April 17.

Mineral Resources of the United States.

The Department of the Interior, Washington, D. C., has issued the annual report of the mineral resources of the United States. This is for the year 1905, and has been prepared by David T. Day, chief of this division of the department. The report is voluminous, containing over 1,400 pages, and taking up in detail the statistics of the many industries under consideration and giving an analysis of the situation and progress made during the year of the report.

A general summary shows that the value of the mineral production for the year 1905 was greater than that for any previous year. The values were $1,623,887,120. The nearest approach to this was for the year 1903, in which the production was a little less than $1,500,000,000. In 1904 the production was about $1,361,000,000.

As heretofore, iron and coal are the most important mineral products. The value of iron in 1905 was $382,450,000. The value of coal was $476,756,963.

The gain in the total value of the mineral production of the year is due to gains in both metallic and non-metallic products, the metallic products showing an increase of over $200,000,000, the non-metallic products of over $61,000,000.

The total production of pig iron in 1905 was 22,992,380 long tons. The production for the previous year was about 16,500,000.

The year was one of extraordinary prosperity for the American copper trade. It witnessed a production exceeding 901,000,000 pounds, an enormous home consumption, prices which were very remunerative and an export trade nearly up to the record. Exports would, however, have fallen off had not China taken nearly 80,000,000 pounds. The value of copper produced during the year was $139,795,716. This was an increase over the previous year of 89,370,576 pounds in quantity, and of $34,165,871 in value.

The consumption of aluminum during the year was 11,343,000 pounds, valued at $3,246,300. The previous year the consumption was 8,600,000 pounds, valued at $2,477,000.

The production of carborundum in 1905 was 5,596,000 pounds. This was less than that for the previous year. The production of artificial graphite was 4,591,550 pounds, valued at $313,980.

The total production of mica during the year was 851,800 pounds of sheet mica, valued at $185,900; and 856 short tons of scrap mica, valued at $15,255.

Facts Pertaining to the Woodlawn Accident.

At a recent meeting of the New York Railroad Club the recent accident to a train on the New York Central & Hudson River Railroad's electric zone was discussed and the following facts were brought out in an address delivered by William J. Wilgus, vice-president of the road. Any improper public impression that the use of electricity on trunk line railroads is attended with new dangers will disturb confidence in what should be welcomed as a distinct advance in the art of transportation. Other wrecks are daily occurring all over the United States, and the reasons freely given are broken rails, the dropping of broken portions of the equipment, high speeds, broken ties, defective roadbed and many other causes in no manner connected with the locomotive. In the case of the wreck in question, the mere fact that the train was hauled by electric locomotives at once placed the new motive power under grave suspicion, and all kinds of unjust attacks and criticisms have appeared. For instance, much stress is laid upon the "low centre of gravity" of the electric locomotive, although this charge is entirely unaccompanied by an analysis of the attendant conditions, such as distribution of weights, method of construction of the pony trucks, etc., which must be taken into account in arriving at a conclusion as to whether or not the centre of gravity had anything to do with the wreck.

There have also been charges made that the construction of the locomotive had not been carefully considered by those entrusted with its design and testing, and that the operating department of the company had not been given full information as to the character of the new motive power, although the first trial locomotive, built by the General Electric and the American Locomotive companies in accordance with rigid specifications approved by the Electric Traction Commission, was tested for two and one-half years on six miles of track of a quality inferior to that in the New York zone, covering 50,000 miles of actual service, at speeds, with different weights of trains, as high as eighty-four miles per hour on tangents and seventy-five miles per hour on curves, and without a single derailment.

Recently very elaborate calculations have been made by the engineers of the two manufacturing companies and of the railroad, and also by Professor Swain, of the Massachusetts Institute of Technology, demonstrating the correctness of the conclusions reached as a result of the practical tests as to lack of any undue effect upon the track, and also as regards favorable comparison with steam locomotives.

As to the reflections on the installation regarding the use of the third-rail direct-current system, it is a fact the third rail worked perfectly as to the automatic cutting off of the current by the circuit-breakers and the insulation of the rail from contact with equipment and passengers.

On this question of the adoption of direct current by the New York Central, there are three points that show conclusively that there was no other course for the company to adopt.

First, the clearances in the Park avenue tunnel, fifteen feet from the top of the rail, absolutely prohibited the use of overhead construction, especially as clearances are required for the occasional passing of steam locomotives with heights of fourteen feet ten inches above the top of the rail.

Second, the legislative act under which the Park avenue viaduct was constructed prohibits any additions such as overhead construction, which would therefore be immediately stopped by injunction.

Third, the existence of an overhead trolley carrying high voltages within the limits of the city of New York is expressly prohibited by law.

Mr. Wilgus deplored any statement that, regardless of local conditions, but any one system, for instance the alternating current, is proper for use in heavy traction. In his practice he had found that every location has to be considered upon its merits. For instance, in the selection of the system for the electrification of the Detroit river tunnel he was instrumental in the preparation of specifications that left the widest latitude to bidding companies for the offering of a design that would meet the requirements of safety, reliability and economy in first cost and maintenance, and the results showed conclusively that for this particular case the direct-current system offered at least equal safety and reliability, and a saving of twenty-seven per cent in first cost and twenty per cent in annual cost of operation, the latter taking into account fixed charges and depreciation.

In conclusion Mr. Wilgus stated that during the searching investigations of the railroad company and also by the coroner's jury and the Board of Railroad Commissioners, nothing had developed that shows that the electrical installation, *per se*, was in any way, shape or manner responsible for the disaster.

American Institute of Electrical Engineers.

The 217th meeting of the American Institute of Electrical Engineers was held in the auditorium of the Engineering Societies' Building, New York city, Friday evening, March 29. President Sheldon called the meeting to order at 8.25 o'clock. The secretary announced that at the meeting of the board of directors held in the afternoon 139 associates were elected, and Professor Alexander S. Langsdorf, St. Louis, Mo., and Leslie Lawrence Perry, New York city, were transferred to the grade of member. At the same meeting the following directors' nominees were selected for the coming election: President—Henry Gordon Stott, New York city. Vice-presidents—L. A. Ferguson, Chicago; W. C. L. Eglin, Philadelphia; James G. White, New York city. Managers—Percy H. Thomas, New York city; B. G. Lamme, Pittsburg; H. W. Buck, New York city; Morgan Brooks, Urbana, Ill. Treasurer—George A. Hamilton, New York city. Secretary—Ralph W. Pope, New York city.

The papers of the evening were then read, as follows: "Lightning Phenomena in Electric Circuits," by Charles P. Steinmetz; "Protection Against Lightning and the Multi-Gap Lightning Arrester," by D. B. Rushmore and D. Dubois; "New Principles in the Design of Lightning Arresters," by E. E. F. Creighton.

The Frank Thomson Scholarships.

At a meeting of the board of directors of the Pennsylvania Railroad Company, held in Philadelphia on March 27, the offer of Anne Thomson, Frank Graham Thomson and Clark Thomson of a fund of $120,000 to establish what are to be known as the Frank Thomson scholarships, was accepted and approved. The fund has been deposited with the Fidelity Trust Company as trustee. The grantors of the trust declare their desire to afford to "sons of living or deceased employés of all the lines of the railroad an opportunity for a technical education so as better to enable them to qualify themselves for employment by the company." Competitive examinations are to be held, open only to sons of Pennsylvania Railroad employés. Beginning this year two scholarships, each of which amount to $600 per year, are to be filled, and every year two will be added. After four years two will be graduated annually, keeping a total of eight men in college all the time.

The Electrical Code Meeting.

As different from the old-time insurance agent, universally made up from failures elsewhere in life, so is the modern underwriter with his contract carefully drawn for indemnity against the range of possibilities of fire damage, so the modern practice of insurance calls to its aid all ranges of technical skill.

The fifteenth annual meeting of the electrical committee of the Underwriters' National Electric Association was an occasion of more than usual importance, and from the nature of its deliberations attracted the attendance of a large number of operating electrical engineers from all parts of the country.

The purpose of this meeting was in connection with proposed amendments to the national electrical code, fundamentally in the interest of preventing avoidable fire loss.

The underwriters generously invited all interested persons to attend and to take part in the deliberations of the meeting, which consisted of over 200 persons.

These persons in their turn were largely representative of others, and in this connection there were other meetings.

First, the underwriters' electrical committee occupied two days in scrutinizing reports of committees and various suggestions embodying 342 different propositions for changes in the rules.

A committee of the National Electric Light Association and also the code committee of the American Institute of Electrical Engineers held sessions devoted to this subject, and the New York Electrical Society held a meeting to discuss the question of the electrical fire hazard.

Therefore when the underwriters held their meeting there was no lack of preparation nor excuse for lack of advance information, for the underwriters had printed in advance a bulletin of twelve pages which contained all committee reports and the numerous suggestions, so that no interested party could be taken by surprise.

These bulletins had been distributed by thousands, and, thanks to extended references in the electrical press, due notice was given.

Although the underwriters might have claimed ownership and possession in the matter, yet they did not rest on any technicality, but gave free and full scope to the expression of opinion by those present.

The result has been in the line of the most thorough treatment of the subject from a conservative standpoint. Advances, particularly in the line of subsidiary appliances, have naturally called for modifications in the rules, but the greater portion of the propositions, certainly over nine-tenths, were defeated.

The day after the underwriters' meetings the National Conference on Electrical Rules held its meeting as an aftermath, but did not criticize the action of the underwriters, except to emphasize in a resolution their opinion that these rules should be confined in their scope to questions of fire hazard, and it is probable that this expression will result in an elimination of certain portions of the code.

The question has been cogently asked, Why should the busy men in positions of responsibility in electrical industries be called upon every year to devote time and attention to this matter of possible changes in the underwriters' rules?

This question carries with it its own answer, for the electric industry has been so alert in its progression as to present new issues and depreciate old ones.

New methods of electrical progress have also introduced methods of greater safety, and it is to their credit that the rules should be modified accordingly.

The final result of this meeting will establish simpler methods in the rules, but there is one question which has received favorable consideration by the National Electric Light Committee and also that of the Code Committee of the American Institute of Electrical Engineers, and finally by the Underwriters' Electrical Committee, and that is that the numerous amendments made in the original national electrical code of 1897 have to some extent impaired the logical arrangement and clear expression of the original; therefore arrangements are being made for the enormous task, in the near future, of recodifying these rules.

Two years is a small allowance for this task to be done in as worthy a manner as the work warrants, but when once done in a proper manner the results will justify the effort.

The Electrolytic Lightning Arrester.

The paper read a short time ago by R. P. Jackson before the American Institute of Electrical Engineers, on "Recent Investigation of Lightning Protective Apparatus," in which an electrolytic device was described, has led C. C. Garrard to give an account of some work in this direction which he conducted in 1901. The work was done in connection with S. Z. de Ferranti, who applied for an English patent on the device, but allowed it to lapse. The idea was to use a number of aluminum dishes fitting one within the other, separated by pieces of ebonite. The dishes were filled with bichromate of potash or some other solution by pouring this into the top of one and allowing it to flow over into the others. They thus formed a kind of tray battery, the lower surface of each dish acting as an anode, and the upper surface as a cathode. Such a device was found to be excellent for placing in series with a spark-gap for protecting conductors against lightning discharges. The sudden rise in voltage broke down the film forming on the aluminum, and after the passage of the discharge this immediately reformed. The trays were also used as condensers of large capacity. Used as lightning arresters they could be set extremely near the working voltage of the line. A number of practical experiments were made, in which this arrester was placed on a 6,600-volt, two-phase system between the bus-bars and the earth. A spark-gap was interposed in the ground circuit, of the ordinary horn type. With this arrangement an arc, when formed, was extinguished quietly. At the instant of the discharge the surface of each disc was covered with a number of tiny sparks. Another test was made on a 2,000-volt continuous-current circuit. Here it had been found impossible to switch off a large current from the generators without having the commutators flash over. By connecting the electrolytic resistance directly across the bus-bars, without any intervening spark-gap, this difficulty was overcome. It was felt, however, that in spite of the excellent performance of the apparatus, there was no field at that time for it in England, and the matter was dropped.—*Abstracted from the Electrician (London), March 15.*

Meeting of Maine Independent Telephone Company Managers.

Thirty-five managers of independent telephone companies in Maine met at the DeWitt House, in Lewiston, Me., on Wednesday, March 20. The objects of the association were discussed, and it was decided to hold another meeting, probably in June. The election of officers resulted as follows: president, F. E. Ebersole, Portland; vice-president, W. H. Ludvey, West Paris; secretary, H. M. Crow, Houlton; treasurer, Harry S. Russ, Mount Vernon. Executive committee: F. L. Ames, Norridgewock; C. B. Chandler, New Gloucester; Dr. Behaught, Calais, and the president and secretary *ex officio*.

National Electric Light Association Street-Lighting Specifications.

A meeting of the committee of the National Electric Light Association to consider street-lighting specifications and new methods for street illumination was held on Saturday, March 30, at the offices of the association in the Engineering Societies Building, New York city. Dudley Farrand is chairman of the committee, and the other members are Louis A. Ferguson, Paul Spencer, C. P. Steinmetz and A. E. Kennelly, all of whom were present.

It is the intention of the committee to frame a model contract between municipalities and central station companies doing street lighting, and to include therein the relative illuminating values of the several types of illuminants now in use for such purposes, so that if a company wishes to change over from one system to another there may be no difficulty in settling the question of relative efficiencies.

This is a subject regarding which many inquiries have been directed to the office of the association, and the report of the committee will be greatly appreciated by the members.

Illuminating Engineering Society.

The next meeting of the New York section of the Illuminating Engineering Society will be held Friday, April 12, at 8.15 P. M., at the Edison Auditorium, 44 West Twenty-seventh street, New York city. Subjects for discussion will be as follows:

"Standards of Light, Primary and Secondary."

"Comparative Rating of Inverted and Upright Incandescent Gas Lamps."

"Desirability of Combining Different Illuminants and Lights of Different Color in Stores."

"Modifying Effect Exercised by Reflectors and Globes Upon the Distribution of Light About a Source."

Progress of the Marconi Wireless Telegraph Company of America.

The report of the directors of the Marconi Wireless Telegraph Company of America for the year ended January 31, 1907, shows total assets of $6,053,850. The report states that the commercial work of the company continues to show improvement. During the past fiscal year the steamship and station receipts showed an increase of $22,961 over those of the previous year, while the station and steamship expenses showed an increase of $6,106. Seventy-eight ocean-going steamers, trading between America and the Continent, are now equipped with Marconi short-distance apparatus. This enables them to communicate with shore stations up to distances of 250 miles and, at the same distance, with each other.

The United States Military Telegraph Corps—A Memorable Meeting.

The Hall of Fair Women, in the Hotel Manhattan, Madison avenue and Forty-second street, has been the scene of many memorable gatherings, but of none so unique, interesting and so characteristic of genuine fraternal spirit as that held on the evening of Thursday last week. The Military Telegraph Corps of the Civil War numbered 1,400 young, active, expert operators who, during that eventful, critical period, kept all parts of the army in close touch with each other and with the War Department, and constituted one of the most important elements in the force which suppressed rebellion and secured the safety and perpetuity of the American Republic. Since that time the forty-two passing years have seen the mustering out of more than 1,200 of the original number. At this reunion fifty members were present and letters from sixty others were received and read. The sons of members were invited to attend, and twenty of these young men were present. The regular members of the corps were General Thomas T. Eckert, Andrew Carnegie, Colonel R. C. Clowry, A. B. Chandler, Colonel William R. Plum, Colonel J. R. Gilmore, Richard O'Brien, Dr. John E. O'Brien, D. H. Bates, Charles A. Tinker, William B. Wilson, George C. Maynard, Charles W. Jacques, Daniel Colestock, A. H. Bliss, John R. Dixon, William L. Ives, Stephen E. Barton, Albert W. Orton, Henry H. Atwater, Frank A. Stumm, Theodore Moreland, M. H. Kerner and William J. Dealy. Among the invited guests were Henry D. Estabrook, John B. Van Every, George Gray Ward, John C. Barclay, Clarence H. Mackay, Thomas F. Clark, William H. Baker, William H. Eckert, Major A. E. H. Johnson, Frederick T. Leigh, C. C. Buel, Horace White, Samuel S. McClure, General N. B. Thurston, William S. Hawk, Charles P. Bruch, William Maver, Jr., Walter C. Humstone, William H. Woolverton, James Kempster, Frank H. Chandler, Belvidere Brooks, John B. Taltavall, F. J. Scherrer, E. M. Mulford, Daniel B. McCoy and others. The management of the reunion was in charge of a committee consisting of Charles A. Tinker, William J. Dealy, D. H. Bates, A. B. Chandler and M. H. Kerner. Mr. Bates presided over the affair with his accustomed tact and spirit and did much to make the occasion a great success. The hall was beautifully arranged and decorated and an excellent and well-served banquet was provided and fully enjoyed by the company The menu was:

Oyster Koktales
Klear Mock Turtle
Celery Olives Salted Amonds
Plankt Shad, Manhattan
Kukumbers
Filly of Beef, Fresh Mushrooms
Potatos Chateau French String Beans
Roman Punch
Rost Squab Stuft
Kurant Jelly Kresses
Salad Manhattan
Fancy Form Ice Kreme
Petty Fours
Chees Koffy
Sauterns Cigars Cigarets
Apollinaris

In commencing the second part of the exercises Mr. Bates presented the name of General Eckert as the Dean of the Corps, who has seen sixty consecutive years' service in the telegraph and is still in active work. The comrades and friends gave an enthusiastic greeting to the general, who feelingly expressed his appreciation and pleasure. The next speaker was Colonel Clowry, the first military telegrapher who performed service on the field of battle, who gave an interesting account of his experiences. Then Colonel Plum, the historian of the corps, told incidents of the service in which he was engaged, and paid high tribute to the men of the army telegraph. Mr. Carnegie was next introduced as the father of the Military Telegraph Corps, and for twenty minutes kept the assembly in a state of delight by his spirited, eloquent address, delivered in the most informal and feeling manner. He made a brief reference to business methods in high financial circles and then turned to reminiscences of his active life, beginning with his service as a telegraph messenger at three dollars a week, describing his tour to Washington with a gang of railroad builders, when they were obliged to go *via* Annapolis because the regular route was obstructed by the secessionists; an immediate call for telegraph operators, and the organization of the telegraph corps. Pointed, pertinent, four-minute talks were given by Chandler, Tinker, Wilson, Maynard, Laird and others. During the evening the exercises were enlivened by appropriate music given under the direction of Mr. Kerner, who also directed a stereopticon exhibition of portraits and scenes of army experiences. A friendly spirit of camaraderie prevailed throughout the entire reunion, making the occasion one of great pleasure to all who were present.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

Localization of Faults on a Three-Wire Network.

Instructions for locating faults are generally limited to the finding of the fault after it has been located on a given length of cable. F. Fernie discusses here the best methods of determining the feeder upon which the fault has occurred. A method sometimes used is first to break the third-wire earth connection and momentarily earth the opposite outer main, to see which instrument needle gives the largest kick. A variation of this consists in quickly cutting out and putting resistance in the third-wire earth connection. This method is useless when there is a motor load on, as the needles are then swinging continuously. The earthing of the positive main is objectionable, and negative faults are more frequent than positive ones. A positive fault nearly always leads to negative and third-wire faults. The earthing of the negative main is not so objectionable, though it is likely to burn holes in the lead at all sorts of places distant from the fault. In modern networks the different districts fed by feeders are coupled together by fuses. On such a network a fault may be localized to a particular feeder if a man be sent around to open all the fuses. Then, at the period of lightest load each feeder is momentarily broken until, on the particular feeder being reached on which the fault exists, the third-wire earth ammeter springs back to zero. This method is rather barbarous, and the following way has been used by the author, which is fairly quick and reliable. The different feeder districts are linked together by fuse switches placed in pillars above ground. Two third-wire feeders should be run to two feeding points as far as possible apart. The network is divided into two distinct parts by means of the fuses, a man going around on a bicycle and opening them. At the station the system is divided into two parts and fed by independent dynamos. The balancers are employed to regulate one section, and the battery to control the other. Two third-wire bus-bars are extemporized, if necessary, and an ammeter connected between each and the earth. If a leak exists it will then show on one or the other of these ammeters. Then, by transferring groups of feeders from one dynamo to the other it is easy to determine within which group the fault exists, and by changing back one at a time the faulty feeder is quickly located. The above method is applicable also for the localization of third-wire faults.—*Abstracted from the Electrical Review (London), March* 15.

Measurements of the Electrical Potential During the Total Solar Eclipse of August 30 at Tripoli, Barbary.

An account is given here by Emilio Oddone of the records made of the electrical potential of the air during the solar eclipse of August, 1905. The author had charge of the measurements made at the Tripoli, Barbary, station. Two electrometers, one of the Exner and one of the Mascart type, were used. These were charged by means of water collectors, which were placed on a terrace, one six metres above the other. The electrometers were tested twice a day, and one of them had been tested before being sent to Tripoli. Records of the air potential were taken for several days before and after the eclipse, in order to obtain the daily curve of potential. These show that the potential of the air has its lowest value at about half-past five in the morning, increasing slowly until seven o'clock, and then more rapidly, and at ten o'clock reaching its highest value, 205 volts. This time is also the hour for the inversion of the wind. After that the potential falls, at first regularly. At half-past one the potential has decreased to about ninety volts, and then begins to rise, and at 5 P. M. reaches a second maximum of about 190 volts. After five it generally falls rapidly. During the evenings the electrometers lose their effectiveness because of a heavy fall of dew. On the day of the eclipse the potential in the morning was about normal. The minimum reached on this day was about an hour and a half earlier than normal. The course in the afternoon was almost the opposite of the normal change. A few minutes after the astronomic contact the potential, then in ascending course, began to diminish considerably. Near the time of totality a sudden maximum appeared, followed by a sudden fall. This was at 2.38 P. M. Another maximum, less pronounced, but well defined, occurred at 3.40 P. M. At five o'clock the potential showed a tendency to rise again, but there was no symmetry. The direct-reading electrometer showed an almost regular and continual ascent from 5 to 9.30 A. M., when the leaves came in contact with the upper plates, showing that the potential was over 250 volts. Unfortunately, the observations were undoubtedly influenced by a high wind which prevailed during the entire day. Clouds of dust also passed across the sky from time to time. For this reason the eclipse can not be considered as the only cause of the higher potentials shown by the direct-reading instrument, because even before the eclipse the potential was rising rapidly. However, if the eclipse had nothing to do with the abnormal conditions, it is worth while to note that at thirty-four minutes past one, four minutes after the initial contact, the potential and energy curves not only interrupted their rapid ascent, but began suddenly to descend. Like observations had been made previously by five observers, and these all showed a similar fall of potential after the eclipse began. During last August's eclipse similar observations were made also by six observers, which showed results resembling those obtained at Tripoli, although the weather conditions were different. — *Abstracted from Terrestrial Magnetism and Atmospheric Electricity (Baltimore), December.*

Choice of Apparatus and Appliances.

A few suggestions for selecting apparatus for electric supply stations are made here by J. D. Ross. So much difference is found in different makes of apparatus that smooth running in a plant can only be got by careful selection. It is pointed out that in spite of the great advance in the design and construction of electrical apparatus, there has been comparatively little advance in the design of apparatus for protecting human life. For this reason the greatest care should be taken in installing high-tension devices, so as to avoid all chances for short-circuiting and making it unlikely that attendants, in a moment of thoughtlessness, may come in contact with dangerous circuits. Where a system feeds transmission lines the switchboards must be designed more liberally, more space being interposed be-

tween live parts and the ground. High-tension switches should be designed so that there is oil between live parts and the tanks, and creepage should not occur on the terminal insulator. For controlling such switches electric operation is preferred. Mechanical control is probably best in small plants, but it is too expensive for large plants; and, besides, then becomes dangerous to workmen. Switches operated by single solenoids have not been as satisfactory as those using two. It is practicable to regulate individual lighting switches automatically, so as to prevent complaints from flickering lamps, due to changing loads. It is almost impossible for an operator to maintain ideal regulation at the end of a long feeder, particularly if each must control a number of such feeders. On alternating circuits the best regulation is given by means of single-phase regulators, as with the exception of motor loads, the phases are nearly always unbalanced, and a polyphase regulator does not admit of regulation of single phases. For 45,000-volt lines the horn arrester is used, two gaps being placed in series with a water resistance connected to earth. The resistance is made from a two-inch fiber conduit thirty feet long, supported vertically by a cross-arm on the pole. The terminal of the second gap dips into the top of the tube. The bottom of the tube rests on the ground, where it is connected to an iron pipe. The tube is filled by forcing water in at the bottom until it overflows at the top, carrying away all dust. In cold weather the water is allowed to flow so as to prevent freezing. For station wiring rubber-covered wire is preferred for low voltages. One side of the transformer circuit is grounded both at the transformer and at the switchboard. Thoroughly fireproofed covering of high dielectric strength should be placed on all important high-voltage buses or wires. The best method of supporting the wires is on angle-iron racks. For outside work nothing smaller than No. 6 B. & S. gauge should be used for voltages over 500. In selecting transformers those of the same make only should be connected in parallel; otherwise heavy cross currents will flow, heating the one having the best regulation. It is doubtful if it is economical to use transformers rated at less than two and one-half kilowatts or larger than twenty-five kilowatts. The latter size is convenient for mounting on poles, and is about right in business districts.—*Abstracted from the Journal of Electricity, Power and Gas (San Francisco), March 16.*

Preliminary Measurements on Temperature and Selective Radiation of Incandescent Lamps.

A preliminary report is made here of an investigation into the selective radiation of incandescent lamps. The method of measurement consisted in projecting, by means of lenses, an image of the filament under investigation upon a flat carbon ribbon. The latter was then heated by means of a current passed through it until it reached the same brightness as the image upon it. The temperature of the ribbon was then determined by means of a Holborn-Kurlbaum optical pyrometer. To study the selective radiation for different colors, monochromic glasses were interposed. Measurements were made in a range from 700 to 1,850 degrees centigrade. Higher temperatures were obtained by extrapolation, but this is believed to be correct within one or two degrees up to 2,150 degrees. The selective radiation of a number of tungsten filaments was studied by measuring the black-body temperatures of the filament for red, green and blue light. One of the filaments had a more polished appearance than the others, and this showed a distribution of energy more nearly like that of platinum. Platinum, by the way, is the best reflector, and therefore shows greater selective radiation than other metals, and would therefore be the most efficient material for lamp filaments, could it stand the high temperatures. During the tests two of the tungsten filaments were burned out, the breaks showing that the tungsten had been fused. The temperatures at which the breaks occurred were 2,950 and 2,850 degrees centigrade, respectively, indicating a mean true temperature of about 3,200 degrees centigrade. Experiments showed that the temperature of the filaments rises when they are first put on the circuit. This is in agreement with the increase in efficiency which has been observed. For the sake of comparison with metal filament lamps, a study was made of the behavior of carbon filament lamps at high temperatures. Owing to the rapid deterioration of the carbon filament, the maximum temperature attained could not be determined accurately. However, it lay between 2,500 and 2,800 degrees centigrade. The results of the measurements show that when the approximate true temperature of the tungsten filament was 1,800 degrees, the black-body temperature for the red rays was 1,700; for the green rays, 1,724; for the blue, 1,734. With an approximate true temperature of 3,190, the black-body temperatures were as follows: For red, 2,900; for green, 2,943; blue, 2,994. Tantalum lamps showed that when the approximate true temperature was 1,800 degrees the black-body temperature for the red rays was 1,700; for the green, 1,727; for the blue, 1,752. With an approximate true temperature of 2,300 degrees the black-body temperatures were as follows: Red, 2,100; green, 2,147; blue, 2,198. A few preliminary measurements made with Nernst glowers at lower temperatures seem to indicate an appreciable increase in the selective radiation for green light. The results indicate that the great gain in efficiency of the tungsten lamp as compared with the tantalum must be attributed to the higher temperature at which the former metal may be worked continuously. Likewise, the marked increase in efficiency of both these lamps over the carbon filament lamps, while due, to some extent, to selective radiation, depends to a greater degree on the higher temperature at which they are operated. This conclusion seems not to be in agreement with the high efficiency of these lamps as compared with the arc lamp, as the temperature of the crater is 1,500 degrees higher than that reached by the incandescent lamps; but there is, in the case of the arc, an enormous loss of energy by conduction from the carbons, and by convective circulation.—*Abstracted from the Bulletin of the Bureau of Standards (Washington), December.*

Conference on Municipal Ownership and Public Relations.

On March 22 a conference of electric light, gas, telephone and railway interests was held in New York city. The conference took the form of a dinner at the Waldorf-Astoria Hotel. The representatives of the American Street and Interurban Railway Association were Charles D. Wyman, Boston, chairman of the committee on municipal ownership; W. Caryl Ely, Buffalo, chairman, and Henry A. Robinson, New York, of the committee on public relations, and Bernard V. Swenson, New York, secretary of the association. These committees will, within a short time, issue a series of questions to be answered by the street railway companies of the country. The data compiled in this way will be used as a basis for reports which will be presented by the committees at the 1907 convention of the association.

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

EDITED BY CHARLES A. PARKER.

Growing with One's Business.

The long-shut floodgates are open, and the great public is being given an opportunity to come and partake of the benefits which electricity offers.

And the sign is good!

Too long has the central station manager devoted his entire energy to the mechanical end of the situation. Too long has he busied himself with the technical, and lived, as it were, in a limited circle of his own making.

To be sure, he builded around himself this excellent circle of co-workers and expert associates; yet it existed in seclusion, so far as the public was concerned. Common folks regarded it as the exclusive circle of the austere elect. No warmth of feeling existed between the two. They were separated by a gulf which grew wider and wider and more formidable as the central station digged and hewed and dived deeper into the mysterious mechanical possibilities of electricity, totally oblivious that such a thing as the public existed, or that a business-getting commercial spirit deserved its consideration.

To-day the manager of the central station and its talent have discarded the smoked glass, and are seeing the situation with clearer eyes. The public is no longer left to slowly drift its languid way into the knowledge of the advantages which electricity offers it. Instead, the central station doffs its superior vestments, limbers up its backbone, rolls up its sleeves, spits on its hands and goes out after business, until to-day it is numbered among other sensible business concerns which realize that they depend upon the goodwill of the public and must, perforce, shape their methods on true business principles.

To this end the central station manager's position takes on an added capacity. It is for him to devise ways and means and measures and schemes, to appeal to his people. Oftener than not he was an able solicitor before he became a manager. Oftener than not he knows the ropes, the trials and hardships, the discouragements and pleasures of the field solicitors. He, more than others, is equipped, by experience, to sympathize, advise with and encourage his outside men. He has reached the point where it is not policy for him to keep to the field of actual solicitation himself, for his presence, his spirit, his knowledge, can be put to greater usefulness inside, devising measures for the business-getting department of his company.

As an example to his outside men, he forms a more or less stimulating inspiration. But he does so only so long as he grows with the business, and keeps alert and alongside current conditions. To slip behind the constantly moving panorama and become a back number endangers his prestige and his ability to pose as a worthy chief.

Conditions have changed remarkably, of late, as to the public's attitude toward electricity, and they are changing almost daily. People are regarding it more as a commodity that they should be interested in. With a campaign of attention-compelling, truthful, forceful printed advertising, exploited by the inventive man-

Electrical exhibit of an enterprising electrical contractor who is being encouraged in every way possible to participate in the publicity campaign of the Union Electric Company of Dubuque, Iowa. This enthusing of electrical contractors has been found to be extremely profitable by many central stations.

ager, and talking to the people in plain, non-technical language, there is no reason why he can not manage this advertising, with systematic plans and the work of his solicitors, and thus go out after new business, and land it.

A number of managers have inaugurated a plan of seeing that each and all of their solicitors interest themselves in the advertising being sent out, to the end that they so familiarize themselves with it that the influence of the advertising and the personal labors of the solicitors work hand in hand harmoniously for results. In fact, this sort of combination effort has proved itself of such worth that a certain central station, whose name is not important to this article, has put into practice the plan of sending to each solicitor's home a copy of each and every piece of advertising matter mailed to its people, at the same time urging that the solicitors take a personal interest in the matter, study it, learn it, and so fit themselves to be ready to be able to talk electricity anywhere and everywhere.

Perhaps the taking pains with and nursing of solicitors may not resemble a Roman holiday for the average central station manager, because he is a busy man and has plenty of his own troubles to contend with. At the same time, his own ability did not come to him while he sat quietly twiddling his thumbs. He worked for it, hustled for it, thought and sweated and exerted himself, got it step by step, slowly, tediously, and sometimes discouragingly—but finally, he arrived.

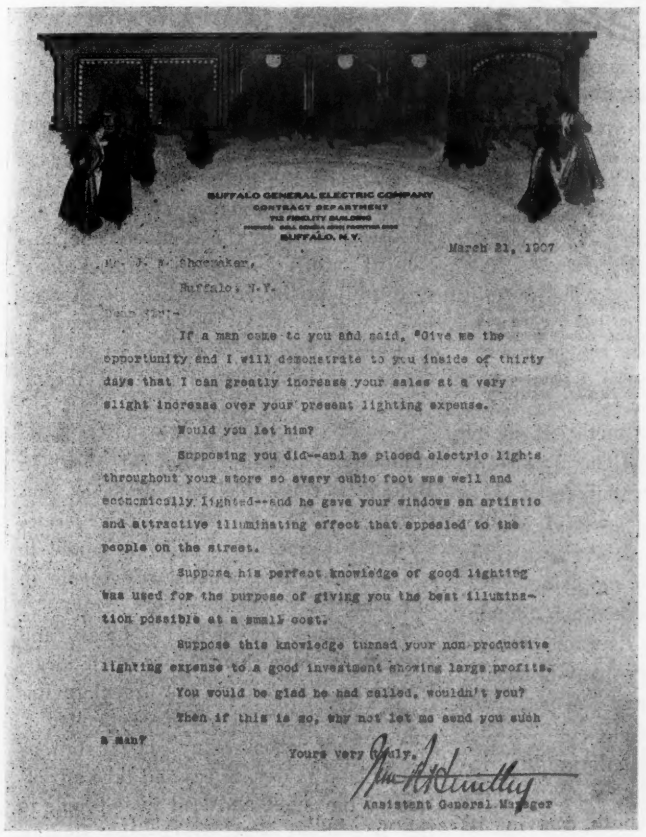
The world isn't turning out an oversupply of geniuses these days, and no manager can safely figure on his solicitors jumping, full-fledged and in perfect working order, like Minerva from the head of Zeus, into a complete knowledge of business-getting capability. There exists no royal road to the learning of this. So it behooves the central manager, who has passed through the trials and tribulations of solicitation, to impart, patiently and persistently, to his generally willing men whatever knowledge he can in this respect.

It is a sad reflection on the race that some men reach a point where they stop growing. When this happens to a central station manager his days of usefulness can be counted on the fingers of a man who has lost several in a saw-mill. The business-getting department of a central station company has no room for fossils. These are the days to push and pull, for the public is just waking up from a delayed consideration of what electricity means to it.

Much depends upon the manager. He can not wisely turn his solicitors loose to go their devious ways. Let a studied policy be inaugurated. Let there be a thorough understanding between solicitors and manager. Let the manager advise, admonish, tutor, train and stimulate his men with a spirit of know-how and aggressiveness. Let them not be like the biblical "dumb driven cattle," but alert and observing even to the point of searching out the latent possibilities existing in their respective territories.

Your solicitor likely has brains and resources, but with just enough of human nature in him to sometimes grow careless or perfunctory in his work. It is the central manager's function to keep the flame glowing, and it is not a difficult task so long as he can create and hold the respect and admiration of his men.

If he can not do that, he can not build up a thinking, studying, observing, busi-



BUFFALO GENERAL ELECTRIC COMPANY
CONTRACT DEPARTMENT
712 FIDELITY BUILDING
BUFFALO, N.Y.

March 21, 1907

Mr. J. R. Shoemaker,
Buffalo, N.Y.

Dear Sir:-

If a man came to you and said, "Give me the opportunity and I will demonstrate to you inside of thirty days that I can greatly increase your sales at a very slight increase over your present lighting expense.

Would you let him?

Supposing you did--and he placed electric lights throughout your store so every cubic foot was well and economically lighted--and he gave your windows an artistic and attractive illuminating effect that appealed to the people on the street.

Suppose his perfect knowledge of good lighting was used for the purpose of giving you the best illumination possible at a small cost.

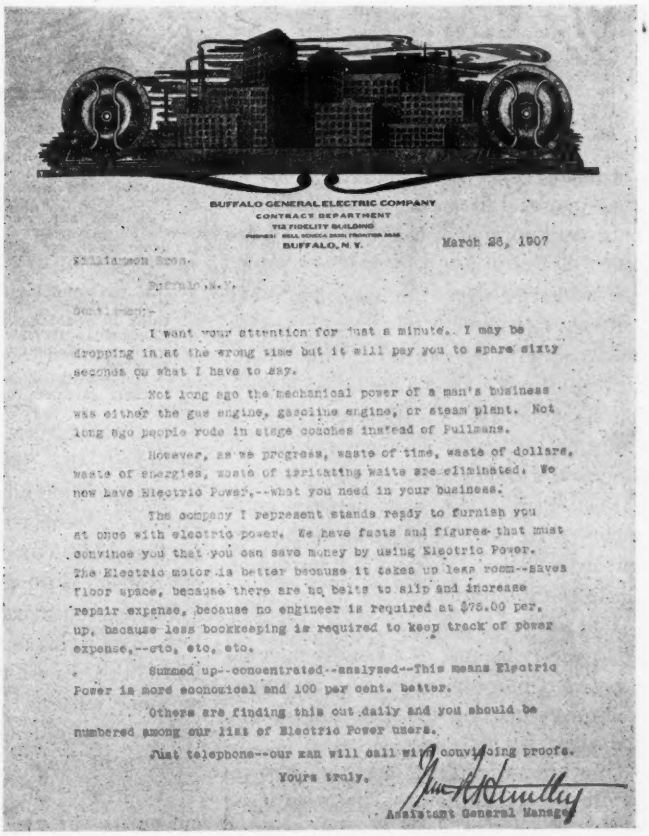
Suppose this knowledge turned your non-productive lighting expense to a good investment showing large profits.

You would be glad he had called, wouldn't you?

Then if this is so, why not let me send you such a man?

Yours very truly,

Assistant General Manager



BUFFALO GENERAL ELECTRIC COMPANY
CONTRACT DEPARTMENT
712 FIDELITY BUILDING
BUFFALO, N.Y.

March 26, 1907

Gentlemen:-

I want your attention for just a minute. I may be dropping in at the wrong time but it will pay you to spare sixty seconds on what I have to say.

Not long ago the mechanical power of a man's business was either the gas engine, gasoline engine, or steam plant. Not long ago people rode in stage coaches instead of Pullmans.

However, as we progress, waste of time, waste of dollars, waste of energies, waste of irritating waits are eliminated. We now have Electric Power,--what you need in your business.

The company I represent stands ready to furnish you at once with electric power. We have facts and figures that must convince you that you can save money by using Electric Power. The Electric motor is better because it takes up less room--saves floor space, because there are no belts to slip and increase repair expense, because no engineer is required at $75.00 per, up, because less bookkeeping is required to keep track of power expense,--etc, etc, etc.

Summed up--concentrated--analyzed--This means Electric Power is more economical and 100 per cent. better.

Others are finding this out daily and you should be numbered among our list of Electric Power users.

Just telephone--our man will call with convincing proofs.

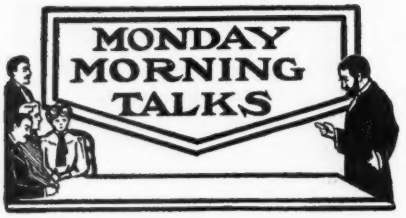
Yours truly,

Assistant General Manager

Samples of the illustrated letters sent out by the Buffalo General Electric Company. The headings on these letters are attractively printed in three colors and the letter is printed facsimile typewritten style.

ness-getting department. And if he can not do that, somebody, from somewhere, some day, is going to come along and take his job.

The central manager is the logical drill-master of the solicitors' corps.



Under this general heading we shall present to our readers a series of bright, stimulating talks to solicitors, which, we believe, will prove valuable to managers of new-business departments in suggesting points which they can profitably bring out in their occasional meetings with the company's representatives.

We shall gratefully accept contributions and suggestions from any of our readers.

I've only got a few minutes this morning, boys, so I'll confine myself to a few words on the value of health in your vocation.

Now don't dodge. I'm not going to tell you how to become a Sandow, or how to diet yourself, or anything like that. Health is such a simple matter of observing a few of Nature's laws, that there is really no excuse for as much sickness in the world as there is.

Remember, a sick man in business is rubbish. He can't do either himself or his employer justice. He's a drag, instead of a help and inspiration.

Doesn't the bright eye, alert step and brisk, cheery manner of a healthy man always court our admiration and attention. There's no denying the man full of vim and vigor for his work.

Of course, we can't all be big and strong, but that's not the idea. The idea is to observe the proper laws of right eating, sleeping, exercise, recreation, etc., in such a way that you'll always be at concert pitch for your work. And you can't be that if you go in for too many late suppers, not enough sleep, too many nights out with the boys, etc., and report next morning feeling like a stuffed owl, and with no desire to work.

There's a limit of endurance in every person. Respect that limit and you'll do better continuous work. Overstep the limit, and you're bound to gradually break down in health and lose your earning power.

We should so regulate our lives that we can come to work every morning keen for our duties. We should forever keep in mind that health is life's greatest asset, and that it can not be properly maintained without proper diet, sleep, fresh air, exercise and recreation.

Don't be one of that vast army of people who merely exist, but live in the truest sense of the word, and utilize and enjoy the many benefits a kind Creator gave you, the greatest of which is health.

And don't forget that your own health is really a matter in your own hands, for you to maintain.

It will be our endeavor, from week to week, to present in this department brief notices of activities among the central stations, as gathered from men who are in the field and, consequently, in close touch with the progress of the new-business idea and its acceptance by central station managers. Contributions to this department are solicited, and will be received with much appreciation by the editor.

If you are doing something a little better than or different from the other fellows, and think it would make interesting reading to ELECTRICAL REVIEW readers, send in your schemes and plans. They will be gladly received.

Address all communications to Charles A. Parker, care of the ELECTRICAL REVIEW.

With valiant Nature's mightiest engine behind it, the Buffalo General Electric Company is peculiarly well fortified to give to its people such powerful, steady, inexhaustible, economical service as only old Niagara is capable of supplying.

Builded upon such a staunch foundation, upon which to rear its whole business fabric, this discerning company is leaving no stone unturned to win the good will and patronage of its people.

"Current Talk," the entertaining, instructive bulletin of the company, goes out on its way once a month, carrying its message of a better era, and proving to all who will listen the glorious promise of electricity for light, power and various other store and domestic uses.

Besides "Current Talk," which this company writes and composes in its own office, it recently placed a large advertising contract with a well-known advertising firm for a series of four direct-by-mail advertising services—one for residents, one for stores, one for power users, and one for prospective sign users. Each of these four services call for two different pieces of advertising per month, consisting of a variety of folders, booklets, mailing cards and facsimile typewritten letters with special design for the heading (see letters illustrated). All of these different pieces of advertising are handsomely designed, printed in two or more colors, on the best of paper, and they are written by men who have made a study of central station advertising which puts them in a position to turn out literature that will bring business, and lots of it.

Of course every piece of advertising except the mailing cards has return postal cards enclosed, by which the parties interested may make an appointment with the company's representative.

Especial effort is directed to the manifold uses of electricity in the home, and as an expected result, there has poured in to the company sufficient new, good business to amply justify the advertising efforts indulged in.

Shop power business has also been aimed at, with such results as might naturally be expected.

All in all, the Buffalo General Electric Company is thoroughly awake and aggressively alert in the commendable mission of tutoring its public, almost down to a unit, in the universalism of electricity, which is rapidly being recognized as a Moses to lead the world out of the wilderness of insufficient light and incompetent power.

Public appreciation, which is being gradually, but surely, brought about in Buffalo, is a possible, nay, probable, condition which a properly educative service of direct-by-mail advertising is bound to achieve, anywhere, among any people in our country.

The clouds are about to break, and through the blue there shines forth, clearly and understandingly the urgent invitation to the universal use of electricity.

And so it behooves any central stations in our land to-day, to see and take advantage of the signs, and lead their people to the new light and power—the coming light and power of all civilized mankind.

The management of the Lima Electric Light and Power Company, of Lima, Ohio, seems to have a very good plan for encouraging and maintaining an electric sign system in its city. The company operates upon a flat rate. All the electric signs are placed upon the same circuit and at a given time current is turned on and every sign is doing business at once. The same process governs when it comes to closing. All are closed from the head, so there is no rivalry or bad feeling as to closing time. And, by the way, it is worth one's while to take a look when things are turned on in Lima. And the end is not yet, they are still coming. Results of vigorous personal solicitation are coupled with judicious and brainy advertising.

Organization of a New-Business Department.

One of the contributors to the prize contest held under the auspices of the Cooperative Electrical Development Association, Cleveland, Ohio, on the subject, "Organization and Conduct of a New-Business Department Suitable for Central Stations in Cities of 50,000 Population and Under," was John G. Learned, of Evanston, Ill. Mr. Learned's paper was not among those which received a prize or honorable mention, but it contains some suggestions which are of interest.

Mr. Learned considers that it is essential for the company to maintain a wiring department at times, and private contractors in the wiring business should be encouraged as much as possible. Local firms handling reliable electrical appliances should also be encouraged to solicit business for the central station company. Experience has shown his company that wiring for a porch light at cost has been the means of securing a large number of customers. Sixty customers were secured out of 275 prospective customers approached with a circular letter. Another proposition for old residences is to wire for six outlets at a concessional price of one-half the actual cost, the outlets to be placed under the direction of the consumer. This proposition was offered to about 600 old residents, out of which number fifty-three responded and twenty-three were secured to the service.

Another method adopted by Mr. Learned's company was to make a standing offer to allow $25 worth of current free to any resident who would wire his home for a certain number of lights during that period, this free current to be used within a specified time. The results of this offer were gratifying, as about forty old houses which, before making the offer, were almost impossible to reach, readily came on the service.

The company also made a proposition to install six lights upon the agreement on the part of the consumer to use electricity for two years, with the added provision that the monthly bill should be at least $1. Seventy residents responded to this proposition, and the company was successful in securing forty-seven old residences out of the seventy prospective customers. The bills for these consumers average about $3.50 per month, this average being taken over a period of eight months. The average cost of wiring each of the above-mentioned houses was about $20.

In tenement and flat buildings it is a good idea to make a bid for the hall lighting, allowing the owner a special commission in the form of a discount, this discount depending upon the number of customers in the building who use central station service. This proposition also applies to office buildings.

The use of signs, hung and connected without expense to the consumer, under a special contract whereby he agrees to use a certain amount of current each month, is a valuable asset to the company.

Motors should be sold at cost, or as near cost as possible. They should be sold on a time basis, and, if possible, rented. The motor should be installed on trial; in fact, anything and everything should be done to obtain the consent of the consumer to take power service.

If a store customer can not be secured in any other way, it is a good plan to wire his window free of charge.

With regard to electrical appliances, Mr. Learned suggests extreme liberality in the matter of trial offers. The standard six-pound flat-iron is a very useful appliance in introducing to the housekeeper the advantages of the electrical utensil.

The cooperation of druggists should be secured, the suggestion being made that an advertising cabinet be placed in each drug store. Over the top of this cabinet an incandescent lamp with "use electric light and power" inscribed on the globe, should be placed. The cabinet should be provided with a glass door, in the back of which advertising matter may be inserted periodically. The rent for space for this cabinet could be allowed in the form of a discount on the druggist's bill for current. This cabinet should contain pockets for advertising matter which is distributed by the advertising company.

BOOK REVIEWS.

"Electrical Wiring and Construction Tables." Henry C. Horstmann and Victor H. Tousley. Chicago. Frederick J. Drake & Company. Leather. 120 pages. 4½ by 6 inches. Diagrams. Supplied by the ELECTRICAL REVIEW at $1.50.

A compilation has been made here of a large number of useful diagrams and tables for electrical wiring, both alternating and direct current. The question of the economy of conductors is discussed briefly, some information on electric illumination is given, as well as formulæ in common use, and standard symbols for wiring plans.

"How to Build a Direct-Current, One-Kilowatt Dynamo or a One-Horse-Power Motor." A. E. Watson. Lynn, Mass. Bubier Publishing Company. Cloth. 100 pages. 5¼ by 6¾ inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $1.

Full working designs are given and explained here for the construction of a bipolar, horseshoe type, direct-current generator with a rating of one kilowatt, or a one-horse-power motor of the same type. Working drawings are given of all parts of the machine, and diagrams for winding.

"Fowler's Mechanical Engineer's Pocket Book." Edited by William H. Fowler. Manchester, England. Scientific Publishing Company. Leatherette. 550 pages. 4 by 6 inches. Diagrams. Price: 1*s.* 6*d.*

In the 1907 edition of this well-known pocket book advantage has been taken to extend the section dealing with steam turbines and other new developments made during the past year. The gas-engine section has also been overhauled in order to bring it into line with current practice. The book contains a large amount of data on mechanical engineering topics, tables of materials, constants and properties, and other information required by the mechanical engineer.

"Long-Distance Electric Power Transmission." Rollin W. Hutchinson, Jr. New York. D. Van Nostrand Company. Cloth. 346 pages. 5½ by 7¾ inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $3.

This book is primarily intended as a reference for engineers and a text-book for students. It is put forward as a clear discussion of the principles of long-distance electric transmission of power. The first three chapters are devoted to a discussion of the laws of hydraulics and the peculiarities of hydraulic machinery. Next the generating apparatus is considered, and this is followed by a discussion of the laws governing the electrical transmission of energy. Chapters VI and VII are given over to a discussion of line construction and transformers; chapters VIII and IX to receiving apparatus, such as motors and converters. Chapters X and XI describe a number of practical plants and point out certain distinctive features of noted long-distance lines. The discussions throughout are clear, and unnecessary mathematical analysis is avoided, thus making the work available almost entirely to those who are not at ease in the higher mathematics. The illustrations are complete and assist considerably in the discussion of the subject, but it is unfortunate that in many cases the half-tones are poor. In these days of cheap photographic reproduction there is little excuse for this, particularly as it detracts much from the appearance of the book.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Wire and Telephone Company of America.

It has come to the attention of the Wire and Telephone Company of America, at Rome, N. Y., that since the fire which destroyed a portion of its plant on February 23, 1907, reports have been circulated that this will affect it in taking care of the requirements of its trade. This company is particularly anxious to have the trade know that the fire will in no way hamper it in the matter of delivery of its various products. The fire destroyed only that part of the plant in which bare copper wire was drawn, and immediate arrangements were made for the drawing of its copper by other mills. The Wire and Telephone Company of America was about to erect a large addition to its plant, which, in connection with the rebuilding of its wire mill, is now well under way. When these buildings are completed it will have one of the most modern wire manufacturing plants in connection with another new and modern building to take care of its telephone business. The new buildings in course of erection will be of brick and steel construction, absolutely fireproof. The entire manufacturing plant will be equipped with sprinkler system, which, in connection with a pumping station of its own, and water tanks of sufficient capacity, will make its fire protection independent. The entire manufacturing plant, including present works, will be operated by electric power, equipment being so arranged that machinery can be driven independently in groups. The handling of copper throughout the works will be done by pneumatic hoists, and all machinery and equipment will be such as experience has demonstrated to be best adapted for the production of high-class work in connection with economy.

The Westinghouse Lamp Company.

A change of company name of more than usual interest to the trade took place April 1, 1907. On and after that date the Sawyer-Man Electric Company will be known as the Westinghouse Lamp Company. Thus the name of this pioneer company in the lighting industry becomes a matter of history. It has, of course, been generally understood for some years past that the Sawyer-Man Electric Company was a Westinghouse interest, and the change of name is but a logical result of changed conditions.

New Type Direct-Current Generators and Balancer Sets.

A complete line of direct-current generators, ranging in size from one and one-half kilowatts to seventeen and one-half kilowatts, has lately been developed by the General Electric Company, Schenectady, N. Y. The machines (Fig. 1) are designated as type CQ and embody the compact cylindrical construction which has been found so satisfactory in the CQ and CR motors. They are especially applicable as exciting units for alternating-current generators or as direct-current generators for small power plant purposes where a low-capacity, belt-driven generator is suitable.

Compactness is the keynote of the design of CQ generators. The bearing heads are so constructed that the machines can be installed on floor, wall or ceiling, thus adapting generators to crowded locations. Because of the general compact construction, as well as the good quality of material incorporated, the magnetic circuits are short and the iron losses are low. In this way very high efficiencies are obtained for such small generators.

Some constructive features deserve special mention. Field and armature coils are form-wound and removable, and both receive a special insulation treatment which renders the coils practically impervious to water. The field coils are held in position by the flanged tips of the steel pole-pieces, which are seated firmly in the field frame by bolts passing through the frame and secured with nuts. The armature coils are held in toothed slots on the core and extend beyond the end flanges, being firmly banded to prevent vibration or movement. This form of winding gives a large radiating surface for the conductors and so keeps the temperature rise very small.

The bearings are arranged with ring oilers, and, as has been mentioned, can be adjusted for wall or ceiling installation by turning the bearing heads through ninety or 180 degrees. Carbon brushes, sliding in finished box guides, are firmly held against the commutator by adjustable individual springs. Due to the excellent electrical constants, as well as the careful commutator and brush construction, the generators will operate sparklessly from no load to full load, without shifting of the brushes.

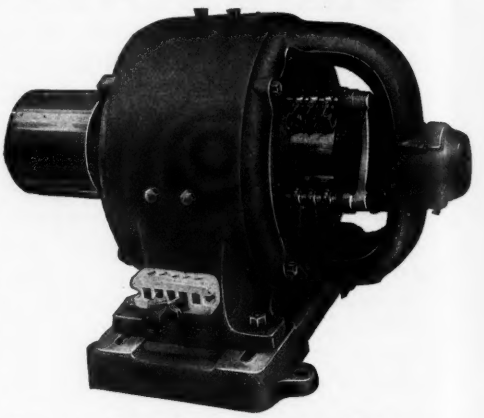


FIG. 1.—NEW TYPE GENERAL ELECTRIC DIRECT-CURRENT GENERATOR FOR SMALL CAPACITIES.

Standard CQ generators, as described, are compound wound for 120 to 125 volts and from 240 to 250 volts full load. Conservative ratings are adopted, so that the machines will run at full load without undue rise in temperature of any part.

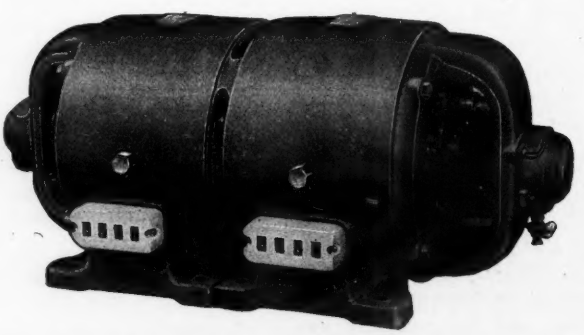


FIG. 2.—NEW TYPE GENERAL ELECTRIC BALANCER SET FOR SMALL CAPACITIES.

A further development of the CQ type

of generator is the balancer set shown in Fig. 2. For the regulation of three-wire systems, the compactness and simplicity of the new machines make them peculiarly suitable. The outfit consists essentially in grouping two CQ generators as one, with both armatures mounted in a single shaft. This elimination of end shield and middle bearing reduces to a minimum the floor space occupied by the balancer sets and permits of grouping the set neatly in a generator room where floor space is already at a premium. In operation, one armature revolves as a motor, while the other acts as a generator, the action interchanging according to which side of the three-wire system has the greater load.

The generator frames are riveted together through space blocks, the common armature shaft being used to eliminate the third bearing. To strengthen the shaft at the point of greatest deflection, an intermediate armature head is mounted between the armatures.

This method of compactly grouping the generators necessitates a somewhat limited amount of air space between the generator frames. Good ventilation, however, is assured by placing on the shaft between the armatures a fan, which draws in air through the ventilating spaces and permits as good temperature guarantees as are obtained in the individual CQ generators. In other respects the detailed construction of the CQ balancer sets duplicate that as outlined for the CQ generators.

Motor-Driven Air-Compressors.

The National Brake and Electric Company, Milwaukee, Wis., has placed on the market a self-contained and stoutly constructed portable motor-driven air-compressor outfit. This outfit has been designed and manufactured for use in cases where the cost of laying a piping system would be prohibitive.

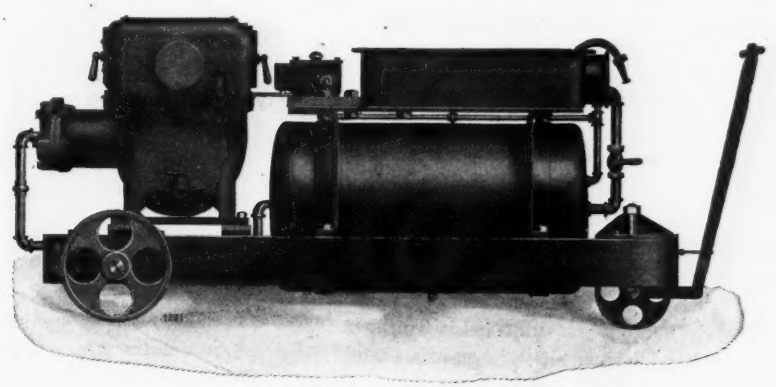
The outfit comprises the new improved National compressor, an automatic type "N" governor and necessary piping, an air-gauge and reservoirs, and a combined switch and fuse, the whole being mounted on a substantial angle-iron frame supported on wheels. The front wheel is hung in a pivoted fork made of cast steel, the outfit being drawn around by means of a wrought-iron tongue.

One of the greatest advantages in the design of National portable air-compressors is the exceptionally small width of the outfit, which is gained by such a disposition of the parts that there is no waste of space on the truck. The width of the outfit over all is but twenty-nine and three-quarters inches.

The air-compressor furnished with the portable outfit is the National Standard New and Improved, in which one of the many distinctive features is the construction of motor and compressor as entirely separate and self-contained units.

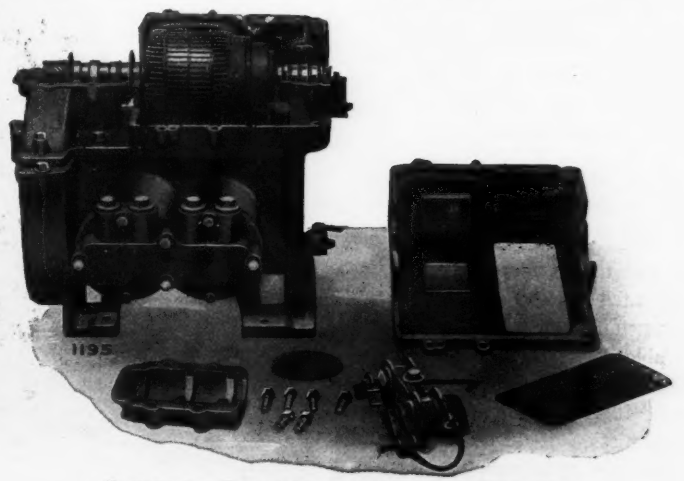
The gear case is constructed as an integral part of the crank chamber instead of being cast separately; such construction makes a highly rigid pump base, reduces the number of loose parts and does not require that the oil be drained from the gear case and crank chamber for inspection of these parts. The compressor is a standard two-cylinder, single-action type with trunk pistons.

The valve head is constructed with the



National Portable Compressor Outfit.

The simplicity of design and construction, as well as the accessibility of all parts likely to need attention, is well shown in one of the accompanying illustrations. The crank-shaft is fitted with a third bearing in the centre, which in addition to supporting and strengthening it at its weakest point, eliminates all tendency of the shaft to fracture at the centre.



Compressor Dismantled, Showing Accessibility.

All bearing and working parts of the compressor are very thoroughly and effectively lubricated by means of the standard splash system of oiling. The gear and crank are enclosed in a bath of oil, which is splashed over all the operating parts of the compressor.

discharge valve toward the centre and the suction valves toward the outside of the head. The discharge pipe runs straight out from the valve head to the main reservoir, thus dispensing with the necessity of attaching elbows, etc. The suction has two openings, one on each side of the valve head; either or both can be used. The suction openings are equipped with straining screens of such design and closeness of mesh that all dust and foreign matter is thoroughly entrained before the air reaches the cylinders.

The gear and pinion are a standard herringbone pattern with finely cut teeth. The gear is of open-hearth cast steel and the pinion of high-carbon steel. Both

gear and pinion are made in halves and riveted together.

The motor is the standard National four-pole enclosed type. The frame of the motor is a cast-steel housing, well proportioned in metal and accurately finished. It is made in one piece and extended in both directions to form a box-shaped covering for the armature and field coils. The pole-pieces are an integral part of the frame, with well-machined pole faces. The material is particularly selected with reference to high magnetic permeability and low hysteresis. The field coils are rectangular in shape and are wound flat, occupying a minimum space. Two field coils are arranged in a horizontal plane to reduce the overall height of the compressor. The coils are wound on formers and are easily interchangeable. The insulation of these coils is of the highest mechanical strength and dielectric properties to withstand the severe service to which such motors are subjected. The field coils are rigidly bolted in position. The field coils can be quickly removed, the one by simply taking off the top half of the motor frame, the other by taking off the top half of the motor frame and removing the armature.

The armature core of the motor is built up of soft sheet steel discs or laminations. These laminations are well japanned and baked and are firmly clamped between end plates which are keyed to the shaft and effectively insulated therefrom with fibre bushings. The coils are received by open slots and held in position by means of fibre blocks forced into V-shaped notches near the top of each slot.

The commutator is of hard drawn Lake copper designed with a liberal wearing depth.

The two brush-holders are each rigidly supported and are designed with an improved patented spring tension device which is constant over very wide ranges and is capable of easy and correct adjustment. The complete enclosure of the motor protects it from the elements, prevents the admission of dust and dirt and obviates the necessity of enclosing the motor in a box. An oil deflector between the pinion bearing and motor thoroughly safeguard the armature winding and commutator from danger of oil.

Inspection spring doors on the side of motor casing and hand holes on top of the motor casing permit ready examination and inspection of armature, commutator and brushes.

The governor, supplied with portable compressor outfits, is the standard type "N" oil pneumatic, which has fully demonstrated its reliability and adaptability to the hardest kind of service.

The type "N" governor is equally as well adapted for operation by direct or alternating current, and its performance is not affected in anywise by variations of voltage.

When the compressor is operating and the air pressure increases, the force on the piston begins to expand the compression spring. As the pressure is increased toward a maximum the upper adjusting nut forces the toggle joint over its centre, causing it, with the assistance of the spring, to deliver a blow to the switch arm which quickly knocks it out of contact and opens the circuit. The arc which follows is instantly suppressed by the oil.

When the air has acted on the piston and has been reduced in pressure, the variation in air pressure causes the spring to return the piston to its normal position, thereby moving the toggle joint over its centre in the opposite direction, and causing it to strike the switch arm and close the circuit.

The pressure at which the governor cuts in is regulated by the extension spring, which is adjusted for the desired pressure by screwing the hexagonal nut on the spindle. Screwing the nut forward on the spindle increases the tension on the spring and requires a lower air pressure for actuating the governor. By moving the nut toward the piston the tension of the spring is increased, causing it to cut in the switch arm at a higher pressure on the piston.

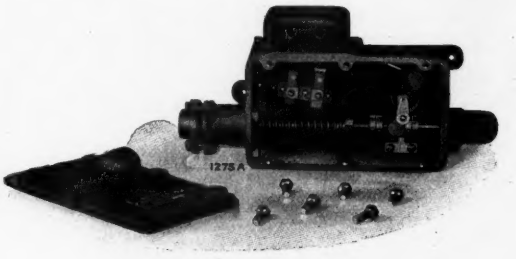
The reservoirs are constructed of cold-drawn seamless steel made in one piece with the bottoms pressed in, and the end of the reservoir shell beaded over to form a joint, which is afterward made absolutely tight by brazing or tinning.

An adjustable pop safety valve is used in addition to the governor to prevent overcharging of the reservoir.

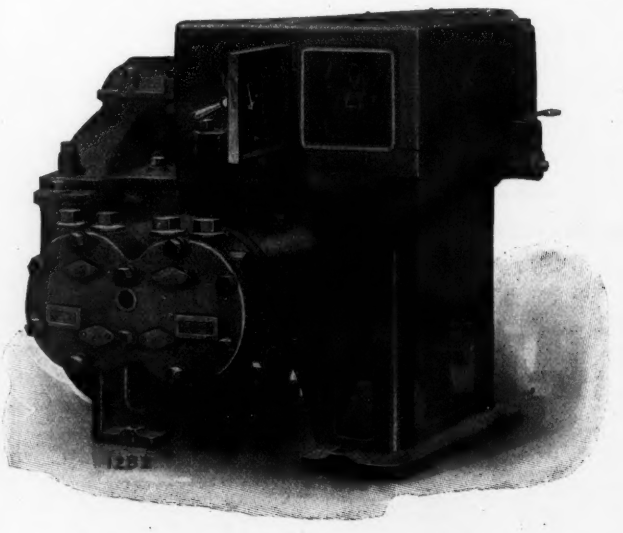
The pressure gauges furnished with National portable compressor outfits are especially suited to this kind of service. The design and careful proportioning of the springs and parts of the gauge is such that they will retain their calibration indefinitely. The air-gauge is mounted on the front end of the hose receptacle and is placed at such an angle that it can be easily read from a distance.

The supply pipe connecting the dis-

BRUSH-HOLDER.



DETAILS OF GOVERNOR.



WATER-JACKETED AIR-COMPRESSOR FOR STATIONARY SERVICE.

charge opening of the compressor to the reservoirs and the governor pipe which maintains the pressure chamber of the governor at reservoir pressure is of high-grade material used in standard National air-brake practice. All piping is of ample diameter to reduce friction losses, with joints threaded with sharp dies and great care taken to insure bottle-tight connections.

A compact, sightly and substantial galvanized iron pan, sufficiently large to contain from seventy-five to 100 feet of hose, is mounted on top of the compressor on the larger sizes of portable outfits and on top of the reservoir on the smaller sizes.

The type "L" water-jacketed stationary compressors are identical in every respect with the compressors just described, except that provision is made for a circulation of water around the cylinders and heads, keeping these parts at a minimum temperature and permitting the machines to be operated continuously.

With the water-jacketed types there is furnished a water governor which automatically cuts off the circulation of water as soon as the compressor is shut down. These governors are very simple and reliable in operation and eliminate the possible neglect to turn the water off after stopping the machine, and in a like manner the water is admitted to the cylinders and heads when the compressor is started up.

South American Electrical Developments.

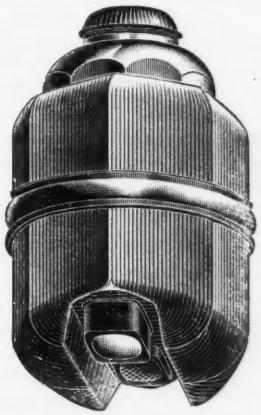
The government of Brazil has granted permission to Messrs. Guinle & Company, of Rio de Janeiro, to sell electricity in the capital city, as well as other important cities in the republic. The contracts for light and power in Nictheroy and other cities along the proposed transmission line have already been let. The initial electric power sources will include several hydro-electric stations just being completed on various waterfalls controlled by Guinle & Company. These have an aggregate capacity of about 50,000 horse-power. The electrical equipment was furnished by the General Electric Company, Schenectady, N. Y. It is expected that work on the transmission lines will be started next June.

Advertising Show.

The next advertising show will be held in Madison Square Garden, New York city, under the management of the Advertising Show Company, May 16 to 23. The Chicago advertising show will be held at the Coliseum, September 7 to 14.

A Durable Finish for Pendant Switches.

The Sarco Company, 906 Sixth avenue, New York city, is applying a special finish to its new pendant switch, which the company claims is a great improvement over the regular polished brass finish. This finish has been designated as "French polish brass." The octagonal shape of the "Sarco" pendant switch readily identifies it, together with the concealing of both buttons on the bottom of the switch. The new finish is a series of fine lines covering the entire octagonal portion of the switch, giving it the appearance of an etched surface. It is claimed that after the switch is lacquered and placed on the market it can be used and handled without the lacquering getting spotted through handling.



SARCO PENDANT SWITCH, WITH FRENCH POLISH BRASS FINISH.

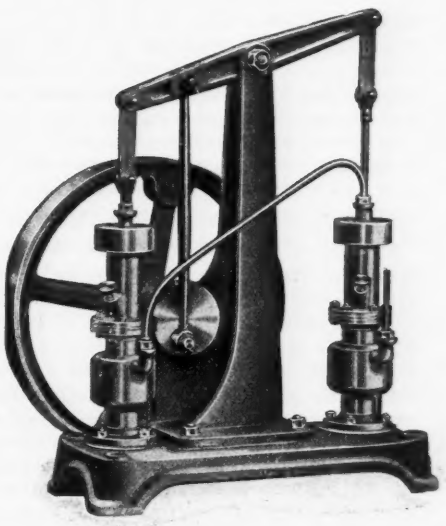
Cook Self-Welding Wire Joint.

The Cook self-welding wire joint is made with one side flat. The tube fits the wires closely, and when the joint is twisted, the flat side is forcibly and naturally drawn into the recess between the wires, stretching the joint tight around both wires. This makes practically a perfect cold weld joint, and it is impossible for moisture or air to penetrate the tube and corrode the wires or the inner surface of the joint. When the wires are inserted in the joint, twisted three times, and the joint is then cut in two, it is almost impossible to discern the line where the inside of the joint and the outside of the wire come together. The tensible strength of the joint is much greater than that of the wire itself. Owing to the fact that the joint binds so tightly on the wire, it is unnecessary to turn back the end of the wire after it has been inserted through the tube.

THE COOK SELF-WELDING WIRE JOINT.

The "Geryk" Vacuum Pump.

The accompanying illustration shows the "Geryk" vacuum pump, manufactured by the Pulsometer Engineering Company, Reading, England. The United States agent is Fahn & McJunkin, 201 East Sixteenth street, New York city. The pump shown in the illustration is specially designed for the production of high vacua in incandescent lamp factories, and a large number of them have been sold for this purpose. The pump is especially useful in connection with the chemical process of exhausting lamps, and is also largely used for flashing the filaments. The pump is made in sizes up to a capacity of 100 cubic feet per minute, or more if required.



THE "GERYK" PUMP.

Current Electrical News

DOMESTIC AND EXPORT.

MEXICAN ELECTRIC NOTES—The corporation being organized by Mexico City interests to handle the merged light and power and street railway interests of La Electra and the Compañia Industrial de Guadalajara will be known as the Compañia de Tranvias, Fuerza y Luz de Guadalajara. The capital will be $11,000,000. The new company will develop additional power at Las Juntas and Juanacatlan, on the Santiago river and will transmit current to Aguascalientes and to mining districts of the state of Jalisco. It is expected to secure a total of at least 20,000 horse-power from the two plants. The purchase price of approximately $3,000,000 will be paid in cash.

NEW CONNECTICUT POWER COMPANY—The Connecticut River Power Company has received a charter from the New Hampshire legislature similar to that enacted last year by the Vermont legislature, and will proceed to build a dam on the Connecticut from Cooper's Point, Hinsdale, to the Vermont shore in Vernon. The plant will develop 12,000 horse-power and more than $1,000,000 will be spent in the undertaking. The power plant will be located on the New Hampshire side of the river. The company has a capital of $200,000, with right to increase to $2,000,000. Henry I. Harriman, Hyde Park, Mass., and Malcolm G. Chace, Providence, R. I., represent the interests who are financing the enterprise.

INDIANA TRACTION MERGER—The Terre Haute, Indianapolis & Eastern Traction Company, with an authorized issue of $25,000,000 stock and $10,000,000 of bonds, has filed articles of incorporation with the secretary of state. This is the holding company toward which the plants of the Philadelphia syndicate, represented in Indianapolis by Hugh McGowan, has been working for nearly two years. The Terre Haute, Indianapolis & Eastern company will acquire by purchase or lease all the Indiana syndicate lines. These include the Indianapolis & Northwestern, the Indianapolis & Western, the Indianapolis Coal Traction Company (Plainfield line), the Indianapolis & Martinsville, the Indianapolis & Eastern, and the Richmond Street and Interurban Company.

WATER POWER TO BE DEVELOPED NEAR GREENSBORO, GA.—The water power of the Oconee river will be developed by the Bibb Power Company at Lawrence shoals, in Greene county, Ga., about sixteen miles from Greensboro. Mr. Howard, of Milledgeville, a civil engineer of Chicago, and Mr. Harris, of Sparta, have been instrumental in organizing the Bibb Power Company, with a capital of $7,000,000. Three companies have been merged into one, and it is stated it will be the largest enterprise of the kind ever projected in the state. Water power in other parts of Georgia will also be developed by the company. The Mary Leila Mills Company and the Southern Cotton Oil Company have agreed to use the electrical power, when it has been transmitted to Greensboro. The power will also be transmitted to Sparta, Eaton and other nearby towns.

EXTENSIVE TROLLEY MERGER PLANNED—Plans are said to be under way for the merging of several important trolley lines in Pennsylvania. Lines which have been mentioned in connection with the deal are the Lancaster Railway and Light Company, the Philadelphia & Western, Philadelphia & West Chester, the West Chester Street Railway and the Philadelphia, Coatesville & Lancaster companies. Officers of both the Philadelphia & Western and the West Chester company have denied, however, any knowledge of the proposed scheme. That a continuous road from Lancaster to Philadelphia, and ultimately from Harrisburg, is the object of those interested in the present scheme is admitted. But it is not known definitely just which of the roads will be used. The Lancaster system extends as far east as Christiana. From there to Parkesburg there is a break of about five miles. But at Parkesburg, and thence to Coatesville, extends the Philadelphia, Coatesville and Lancaster. The West Chester Street Railway runs from Coatesville to West Chester, while entrance into Philadelphia from West Chester is made over the Philadelphia & West Chester road.

POWER STATION NEAR MECHANICSVILLE, N. Y., FOR THE DELAWARE & HUDSON COMPANY—The actual work of constructing the power plant to be erected on the property recently purchased by the Delaware & Hudson Company on the bank of the Hudson river just south of Mechanicsville, has been begun by the Hudson Valley Construction Company of Troy, N. Y., to whom the contract has been awarded. It is proposed to build a steam turbine power plant for generating electric power for the Hudson Valley Railway Company, including large buildings and an elaborate system of tracks, trestles and coal storage grounds. Spurs from the main line of the Delaware & Hudson Railroad will run to the property from both north and south, and, according to the plans prepared by J. G. White & Company, the power station will be erected about 1,000 feet north of the dam of the Hudson River Electric Power Company. The engine room to be constructed will be about 180 feet by 70 feet and the boiler room about 180 feet by 75 feet.

ELECTRIC ROAD TO PARALLEL THE WABASH—The Toledo, Wabash & St. Louis Railroad has been incorporated and will build an electric line from Toledo to St. Louis, paralleling the Wabash steam railroad for a considerable distance. C. D. Whitney, of Toledo, who was formerly connected with the Clover Leaf as general traffic manager, is president of the new company. The new road will pass through Defiance, Fort Wayne, Indianapolis, Terre Haute and other cities of less importance. As near as possible it is the purpose to make the new road an air line between Toledo and St. Louis. The company has been financed and work has already progressed to a considerable extent. The officers of the road are: C. D. Whitney, president; George G. Metzger, vice-president; J. P. McAfee, treasurer; S. L. McAfee, secretary; W. F. Tyler and Clem V. Wagner, attorneys; Riggs & Sherman, consulting engineers. The company has already taken over the water power electric plant at Miami, from which it will operate the line between Toledo and Defiance. It has secured an adjacent quarry from which it will do its ballasting. The right of way between Toledo and Defiance practically has been secured and it is expected that just as soon as the contract can be let work will be started. The company has leased general offices in Toledo. The preliminary plans, profiles and estimates have all been made. The first section of the road between Toledo and Defiance will be completed within a year. The next section to be built will be between Defiance and Fort Wayne, where the right of way has been secured. The third section will be between Fort Wayne and Indianapolis, touching Muncie. The last section will be between Indianapolis and St. Louis, passing through Brazil, Terre Haute, Effingham, Vandalia and East St. Louis. The capitalization of the company is named at $6,000,000. There are to be no bonds and no preferred stock.

EDUCATIONAL NOTE.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY—The Massachusetts Institute of Technology, Boston, Mass., has issued a bulletin descriptive of the 1907 summer courses. These summer courses are held during the months of June and July, supplementing the work of the regular school year. The requirements for admission, and in general the work performed and the final examinations are expected to correspond with those of the regular school year, and similar records and reports are given. These courses include instruction in the following subjects: mathematics, mechanics, drawing, mechanic arts, modern languages, chemistry, physics, civil engineering, mechanical engineering, architecture and biology. The Massachusetts Institute of Technology has also issued information in regard to entrance examinations for the coming year. These will be held in Boston from June 26 to 29, and on September 24, 25 and 26. Examinations are also held in many other cities of the United States and in a number of foreign countries.

ELECTRIC LIGHTING.

PHELPS, N. Y.—The Niagara Falls, Lockport & Ontario Power Company has been granted a franchise by the town board of Phelps.

LAKIN, KAN.—C. H. Waterman and Thornton Thorpe have been granted an electric light franchise by the city council.

PRICEBURG, PA.—The Priceburg Electric Light Company has purchased a tract of land in Priceburg. A plant will be erected on the site.

HARTFORD, CT.—The Rockville Gas and Electric Company will extend its electric light service to Ellington during the coming summer.

SENECA FALLS, N. Y.—At a special meeting the town board granted a franchise to the Niagara, Lockport and Ontario Power Company.

SHERBURNE, N. Y.—The town has voted to bond the village in the sum of $15,000 for the purpose of building a municipal electric light plant.

ASBURY PARK, N. J.—The city has renewed its lighting contract with the Atlantic Coast Company for two years, dating from June 1 next.

DEL RIO, TEXAS.—W. H. Wolff, of Dalhart, Texas, has purchased and will improve and operate the plant of the Del Rio Electric Light and Ice plant.

GALENA, ILL.—After an unsatisfactory experience with a municipal lighting plant, Galena has decided to sell its plant to a private corporation.

NORTHAMPTON, MASS.—The selectmen have granted a franchise to the Easthampton Electric Company, whose officers are mostly residents of Amherst.

FERGUS FALLS, MINN.—The state board of investment has authorized a loan of $80,000 to the city of Fergus Falls, for the purchase of its waterworks and lighting plant.

ELIZABETH, N. J.—The sum of $2,000 has been appropriated by the city council to provide for forty-three additional arc lights that are to be distributed throughout the city.

NEWARK, N. J.—Frederick O. Runyon has been selected as consulting engineer to prepare a report for the board of works on the proposition to harness the city's surplus water supply to light the streets.

CORONA, CAL.—At a meeting of the Corona Gas and Electric Company, E. A. McGillivary was elected president. It is authoritatively stated that extensions to the plant will be made and the rates reduced.

WICHITA, KAN.—The United Gas Improvement Company, which has purchased the Wichita Gas, Electric Light and Power Company, announces that new machinery will be installed in the plant at a cost of $75,000 to $100,000.

COHOES, N. Y.—The Hudson River Electric Power Company, which was granted a franchise to furnish power for lighting purposes, expects to spend about $200,000 in equipping and installing its system during the coming year.

AUSTIN, TEX.—The Merchants' Electric Light and Power Company, of Gainesville, has filed an amendment to its charter, changing its name to the Gainesville Electric Company and increasing its capital stock from $25,000 to $50,000.

COLORADO SPRINGS, COL.—The work of construction on the power plant of the Empire Water and Power Company is to be pushed as soon as the plans are completed and $500,000 in bonds have been underwritten for the project.

MILWAUKEE, WIS.—The franchise ordinance of the Plankinton Electric Light and Power Company has been passed by the common council. The franchise will expire in 1935. The territory covered by the franchise is the lower Fourth ward.

GEORGETOWN, WASH.—The Seattle Electric Company has been awarded a five-year contract for the lighting of Georgetown. Lights are to be installed by October 12, 1907; the contract expires October 3, 1912. Five dollars per month per arc light is the price the city pays.

SEGUIN, TEX.—At a meeting of the city council the report of the committee on the purchase of the electric light plant was received and accepted. The report as adopted calls for a price of $50,000 and $10,000 additional to be spent in improvements in one year.

SCHENECTADY, N. Y.—The Ballston town board has granted a franchise to the Hudson River Power Company to erect poles through the town and to string wires for the purpose of furnishing light to Ballston Lake, Burnt Hills and other sections of the town.

BISHOPVILLE, S. C.—The Bishopville Light and Power Company has decided to accept the proposition made by the town council of Bishopville for the purchase of the electric system of the company with some slight modifications and to transfer the entire plant to the council for $20,000, part cash.

PARIS, KY.—At a regular meeting of the city council, the matter of renewing a contract with the Paris Electric Light Company was taken up and favorably acted upon. The contract calls for thirty-five arc lights at an annual cost of $90 per light, which is $20 per light less than under the old contract.

GOLDFIELD, NEV.—Owing to the immense volume of business and the ever-increasing demand for additional power, the Nevada Power Company is to reincorporate and issue new bonds and stock. In future the company will be known as the Nevada-California Power Company, with general offices in Denver.

KAUKAUNA, WIS.—Reedsville has voted for a municipal lighting plant to be operated in connection with the waterworks system recently built. The action was determined at a special election, at which the vote stood three to one in favor of municipal lighting. Additional bonds will be issued to cover the expenditure.

STEAMBOAT SPRINGS, COL.—The board of trustees has decided by a unanimous vote to sever relations with the Steamboat Springs Electric Light Company and has granted a provisional franchise to a new company to erect poles and string wires through the public alleys. It also promised to enter into a contract for street lighting.

LOS ANGELES, CAL.—The stockholders of the Edison Electric Company, of Los Angeles, have approved the increase in the authorized common stock from $6,000,000 to $10,000,000. Of the additional $4,000,000, $1,200,000 will be offered to shareholders at seventy-five. The first dividend on the common stock, at the rate of five per cent per annum, will be paid August 15.

LOS ANGELES, CAL.—Electricity for light and power will be delivered to urban consumers during the next fiscal year for nine cents per kilowatt-hour; this is a reduction of one cent per hour from the present rate. The reduction was announced at the termination of a conference in which the mayor, the council and the representatives of the local power companies took part.

ALBANY, N. Y.—The Schoharie Light and Power Company has certified to the secretary of state that two-thirds of the stockholders have voted to extend the existence of the corporation fifty years from the time specified in the original certificate of incorporation. The certificate is signed by C. E. Hewitt, president of the company, and N. G. Hubbard, secretary, and is acknowledged in New York county.

ELMIRA, N. Y.—A certificate that the capital stock of the Elmira Water, Light and Railroad Company has been increased from $1,000,000 to $2,000,000 has been filed in the county clerk's office. This action was authorized by the directors of the company, following the expenditure of large sums on improvements. The certificate provides for 10,000 shares of preferred stock limited to five per cent dividends.

GOUVERNEUR, N. Y.—The franchise adopted by the village board of trustees and the Northern Light and Power Company of Potsdam has been signed by President Charles McCarty, of the village, and Vice-President Page, of the power company. The franchise as granted calls for the completion of the power line to this place from Hannawa Falls within a year from the date of the agreement. At least 500 horse-power must be delivered at that time.

CASPER, WYO.—The Casper council has notified the local electric light company and the Rocky Mountain Bell Telephone Com-

pany that all overhead wires must be removed from the business district by September 1. The council has also cut in twain the rates for electricity charged by the local company. The rate for incandescent lighting has been twenty cents per kilowatt-hour. The council has fixed the rate at ten cents per kilowatt-hour.

SODUS, N. Y.—The town board of Ontario held a special meeting to listen to an application presented by the Sodus Gas and Electric Light Company for a franchise in that town. The franchise was granted on condition that the construction of a lighting system be commenced within one year and light supplied within two years. The company will build first to Williamson, where a franchise was obtained some time ago, and then to Ontario, if a sufficient number of contracts can be secured there.

BELLEVILLE, ILL.—Notice has been filed in the recorder's office at Belleville of the change of name of the Belleville Gas and Electric Company to the St. Clair County Gas and Electric Company and the increase of the capital stock from $350,000 to $3,500,000. A meeting of the directors of the company was held at East St. Louis at which the East St. Louis Gas and Electric Company and the Belleville Gas and Electric Company were consolidated and placed under one management.

SOUTH FRAMINGHAM, MASS.—In its report to the town, the joint committee of the selectmen and lighting committee, appointed to consider the purchase of the Framingham Gas, Fuel and Power Company and the Edison Electric Illuminating Company by the town, recommends that the town take no action in either of these premises at present. The committee has reached this conclusion, it is stated, because of lack of interest in the question of municipal ownership of a lighting plant.

WASHINGTON, D. C.—At a meeting of the House Rivers and Harbors Committee it was decided to abandon for this session Representative Alexander's bill providing for the diversion from the lower Niagara river of not over 40,000 cubic feet of water per second by the lower Niagara River Power and Water Supply Company at a point not less than one mile below the falls. This action was taken to allow of an investigation of the effect which the diversion of water would have on the rapids and in answer to requests for hearings on the part of interested parties.

BOISE, IDA.—At a meeting of the stockholders of the Electric Power Company, new officers were elected and an interesting report made by the president, H. C. Wyman. The new officers elected are: William and Sinclair Mainland, W. H. Ridenbaugh, Harry C. Wyman and H. D. Pope, directors. Harry C. Wyman was chosen president and general manager; W. H. Ridenbaugh, vice-president; H. D. Pope, secretary and treasurer. The report of Mr. Wyman, president of the company, gave the history of the company, together with that of the great Ox Bow power project, which will cost over $2,000,000.

ATLANTA, GA.—The Hall-Illges Company, engineers, who were employed by the city to submit reports as to the cost and feasibility of establishing municipally owned electric lighting and gas plants, has filed a report on the electric plant. The report deals only with such a plant as the city would need to supply its own lights. The report states that an electric lighting plant which would supply all the current needed for the city lights could be erected either in connection with the city waterworks or the incinerating plant at a cost of $271,000; that with such a plant, every expense, including interest, being taken into consideration, the city could save $35,000 a year on the present cost of city lights. The lighting now costs the city about $90,000 a year.

MACON, GA.—The stockholders of the Bibb Power Company, recently organized in Macon for the purpose of developing the water power of the Flint, Ocomulgee and Oconee rivers, have elected the following officers for the initial term: W. J. Massee, of Macon, president; J. C. Walker, of Marshalville, vice-president; John T. Moore, of Macon, treasurer; M. Felton Hatcher, of Macon, secretary; J. L. Anderson, of Marietta, assistant secretary and treasurer; Charles F. Howe, of Milledgeville, chief engineer, and Walter T. Johnson, of Macon, general counsel. The board of directors is composed of the above officers with the exception of J. L. Anderson, and with the addition of Judge John T. Allen, of Milledgeville, and M. H. Massee, of Macon. President Massee states that engineers will commence actual work on the project at once, and that everything will be pushed to an early completion.

TELEPHONE AND TELEGRAPH.

POST FALLS, WASH.—The Interstate Telephone Company is preparing to put in an exchange at Post Falls.

TORONTO, CANADA—The Bell Telephone Company has offered $20,000 a year for an exclusive franchise in Toronto.

OMAHA, NEB.—The Nebraska Telephone Company has filed renewed articles of incorporation, increasing the capitalization to $10,000,000.

POMONA, CAL.—The Pomona Valley Telegraph and Telephone Union has given orders for the inauguration of a branch station at Claremont.

OMAHA, NEB.—The Independent Telephone Company has begun construction on its new automatic telephone plant in Omaha, and has taken out a building permit for a warehouse for the storage of its construction supplies.

LEAVENWORTH, KAN.—A cable falling across a live trolley wire started a blaze in the old central office of the People's Telephone Company which completely destroyed the plant. A new plant costing over $100,000 is nearly completed.

LAKE VIEW, N. Y.—The first meeting of the Lake View Telephone Company was held March 16. The following officers were elected for the coming year: president, Fred E. Lord; vice-president, William Newstead; secretary, Frank Kane; treasurer, Fred King.

MONTPELIER, VT.—The Vermont Home Telephone Company, which has a franchise to operate in Rutland and other towns in Vermont, has given a mortgage to the Empire Trust Company, of New York city. The company is to issue bonds not to exceed $1,000,000.

POCATELLO, IDA.—The Soda Springs-Lago Telephone Company has filed articles of incorporation with the county recorder. The principal place of business is Soda Springs. The directors are E. D. Whitham, Joe H. De Witt and William H. Anderson, all of Soda Springs; David Miles, of Niter, and C. H. Mickelsen, of Borah. The capital stock is $10,000, of which $2,500 has been subscribed.

DRESDEN, TENN.—The Weakley County Rural Telephone Company has been organized. It expects to reach out to Latham, Dukedom, Palmersville and Fulton, Ky., and connect with the rural lines there. All the northern part of Weakley county is covered with these rural lines, nearly every farmhouse having one. It is expected that soon they will extend into the central and southern parts of the county, with headquarters at Dresden.

BLAIR, NEB.—At a regular meeting of the board of directors of the Blair Mutual Telephone Company the purchase was authorized of a two-story brick building in the centre of the business portion of the city. As soon as the necessary changes are completed, the company will move into the new quarters. A graduated scale of prices for telephones in business houses was also adopted. W. P. Cook, who has been the central office manager since the company started some six years ago, has tendered his resignation, to take effect May 1.

DATES AHEAD.

West Virginia Independent Telephone Association. Wheeling, W. Va., April.

Iowa Electrical Association and Iowa Street and Interurban Railway Association. Annual meeting, Clinton, Iowa, April 18, 19 and 20.

Southwestern Gas, Electric and Street Railway Association. San Antonio, Texas, April 18-21.

Oklahoma Electric Light, Railway and Gas Association. Annual meeting, Oklahoma City, Okla., April 22-23.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

Texas State Electric and Gas Association. San Antonio, Texas, May 14-16.

Virginia State Independent Telephone Association. Annual meeting, Norfolk, Va., May 21.

American Society of Mechanical Engineers. Annual meeting, Indianapolis, Ind., May 28-31.

National Electric Light Association. Annual meeting, Washington, D. C., June 4, 5, 6 and 7.

Association of Railway Telegraph Superintendents. Annual meeting, Atlantic City, N. J., June 19-20.

American Institute of Electrical Engineers. Annual meeting, Niagara Falls, N. Y., week of June 24.

PERSONAL MENTION.

MR. E. P. WETMORE has been appointed general manager of the Augusta (Ga.) Street Railway Company.

MR. ROBERT C. SHAAL, formerly with the General Storage Battery Company, New York city, has accepted the position of sales engineer of the Bliss Electric Car Lighting Company, as assistant to the vice-president, Colonel John T. Dickinson, with headquarters at the company's office, Fifth avenue and Forty-fourth street, New York city.

MR. J. F. W. BUNSEN has been placed in charge of the southern office, in Charleston, S. C., of Muralt & Company. Mr. Bunsen, who is a nephew of the late Professor Bunsen, the inventor of the burner which bears his name, has had a wide experience in designing and erecting important engineering works. The break-water system built around the city of Galveston is constructed in accordance with his original ideas and plans which were submitted shortly after the Galveston flood by Mr. Bunsen, who was at that time engaged as the mechanical superintendent of the American Cotton Company. Mr. Bunsen will have charge of Muralt & Company's various projects in the southern states, especially the large power plant which the company is now building for the United States government at the Charleston navy yard.

NEW MANUFACTURING COMPANIES.

BUFFALO, N. Y.—Articles of incorporation for the C. E. Brack Electrical Company have been filed at the office of the county clerk. The capital stock is $10,000. Charles E. Brack, William A. Brack and Irwin Gelser are the directors.

TRENTON, N. J.—The Enamel Electric Sign Company, of Atlantic City, has been incorporated with a capital of $50,000. The incorporators are Vincent A. Ferhaugh, Charles R. Lewin and Henry D. Brown. The company is to manufacture electric signs.

MERIDEN, CT.—The electrical business which has for some years been conducted by E. B. Wilcox, under the name of the Connecticut Electric Equipment Company, has been incorporated and will be conducted under the same name. The capital stock of the company is $10,000, divided into 400 shares of the par value of $25 each. The company will manufacture and deal in telephones and telegraph apparatus and electrical machinery. The incorporators are Edson B. Wilcox, A. B. Wilcox and L. T. Fuller.

NEW INCORPORATIONS.

BIRMINGHAM, ALA.—Powell Electric Company. $2,500. Incorporators: A. S. Powell, George G. Neal and Matilda M. Powell.

AUSTIN, TEX.—Cañon City Light and Ice Company, of Cañon City. $15,000. Incorporators: L. C. Lair, D. A. Park, L. T. Lester, J. Frank Smith and J. C. Pipkin.

KILLEEN, TEX.—City Light and Power Company. $10,000. Incorporators: W. R. Burke, W. R. Barber, Will Rencier, Sam Rencier and John McDowell.

ALBANY, N. Y.—Trojan Railway Company, Troy. Street railroad. $200,000. Incorporators: Joseph A. Powers, J. Thomas Dennin, John Flynn, Troy, N. Y., and others.

ALBANY, N. Y.—Fort Johnson Electrical Company, Amsterdam. Electrical and mechanical engineers. $3,000. Incorporators: George J. Helling and Charles E. Henderson, Amsterdam, N. Y.; Harry W. Bordwell, Gloversville, N. Y.

RICHMOND, VA.—Northside Light and Water Company. $50,000. Officers and members of the board of directors for the first year: J. T. Goodwin, president; F. F. Rennie, vice-president; C. D. Wilder, treasurer; H. M. Starke, secretary; directors: J. T. Goodwin, F. F. Rennie, C. D. Wilder, H. M. Starke, Albert F. Dalton, James C. Bowman.

ELECTRICAL SECURITIES.

Yielding to the manipulations of a reckless bear interest in the stock market, prices touched a lower level last week than was reached on the memorable panic day, March 14. The publicity, however, given to the methods and the real reasons for the adverse conditions in the stock market brought about an indignant and healthy reaction, which, while it did not very materially advance prices, has evidently put a permanent stop to further liquidation of a like character. It is now apparent that the demoralization and swift decline in prices did not take place because of any really adverse factor, but because of the manipulations of men who guessed aright the market's apprehension and took advantage of a hysterical condition to force prices lower than the present stable condition of industry justifies. There is one fundamental basis for satisfaction, however, in the present condition—that is, that even under considerable shrinkage from the present condition of prosperity—and this is not expected by those who appear to be well advised—the present prices which have been placed upon securities discount any considerable financial losses, as far as dividends are concerned, to those holding as outright owners the investments which have been assailed. Reports from all sections indicate that there is less uneasiness with regard to Federal interference with the corporations which are to-day earning and distributing vast amounts of the nation's wealth, and that the retrenchment which was heralded so widely a few weeks ago is not likely to be so extensive as was at first announced. The payment by the United States government of the millions of dollars' worth of bonds which mature this summer, under the conditions set forth in the recently passed Aldrich bill, will also place in circulation a handsome amount of currency. This can not fail to make money rates a great deal easier, with the resulting beneficial effect of extensive manufacturing rehabilitation and developing for better resources to meet a demand which, if it does not materialize at once, will be stimulated by the proper publicity methods.

ELECTRICAL SECURITIES FOR THE WEEK ENDING MARCH 30.

New York:	*Closing.*
Allis-Chalmers common	12½
Allis-Chalmers preferred	28
Brooklyn Rapid Transit	50
Consolidated Gas	122¾
General Electric	145
Interborough-Metropolitan common	24¾
Interborough-Metropolitan preferred	59½
Kings County Electric	126
Mackay Companies (Postal Telegraph and Cables) common (ex-dividend)	67
Mackay Companies (Postal Telegraph and Cables) preferred (ex-dividend)	67
Manhattan Elevated	134
Metropolitan Street Railway	90
New York & New Jersey Telephone	112
Western Union	80⅝
Westinghouse Manufacturing Company (ex-dividend)	147

Directors of the New York & New Jersey Telephone Company have declared a regular quarterly dividend of 1¾ per cent on the capital stock. Heretofore the dividend has been 1½ per cent quarterly with an extra dividend of 1 per cent at the close of the year, making 7 per cent in all. The dividend places the stock on a straight 7 per cent dividend basis and the extra dividend disbursement will be eliminated. The dividend is payable April 15 to stock of record April 10.

Boston:	*Closing.*
American Telephone and Telegraph	119
Edison Electric Illuminating	212
Massachusetts Electric	57
New England Telephone	115
Western Telephone and Telegraph preferred	70

Philadelphia:	*Closing.*
Electric Company of America	9½
Electric Storage Battery common	54
Electric Storage Battery preferred	54
Philadelphia Electric	7⅝
Philadelphia Rapid Transit	15⅛
United Gas Improvement (ex-dividend)	84¼

Chicago:	*Closing.*
Chicago Telephone	117
Chicago Edison Light	135
Metropolitan Elevated preferred	63
National Carbon common	75
National Carbon preferred	110
Union Traction common	—
Union Traction preferred	—

ELECTRIC RAILWAYS.

WASHINGTON, PA.—The East Washington borough council has granted a franchise to the Pittsburg Railways Company.

BLOOMINGTON, ILL.—The sale of the City Railway plant at Lincoln to W. H. Schott, of Chicago, has been announced, the reported price being $150,000. It is said that Schott buys the plant for the Illinois Traction Company, now building an interurban line through Lincoln to connect Bloomington and Springfield.

MONTREAL, QUEBEC—The Silver Belt Electric Railway Company is the title of a company which proposes to construct an electric line from Latchford to Cobalt, Haileybury and New Liskeard. Branches will also be run into various mining camps. Mr. Harvey Graham is president and Mr. A. J. Young one of the directors.

SEATTLE, WASH.—The Seattle, Chelan & Spokane Railroad Company has been incorporated with a capital stock of $17,000,000. The proposed line leaves Seattle on the west side of Lake Washington, extends through the exposition grounds, touches Snohomish and runs to Sedro-Woolley on its way through the mountain pass to Spokane.

HELENA, MONT.—New York, Chicago, Helena and Butte capitalists this year will build an electric line between Helena and Butte, at a cost of $3,000,000. Work will be begun at once. The distance is about fifty-five miles and the road will cross the main divide of the Rocky Mountains. Power will be derived from the Missouri river at Helena.

ABERDEEN, WASH.—It is definitely announced that the Grays Harbor Railway and Light Company will at once begin work on a large power-house near Electric Park, midway between Aberdeen and Hoquiam. This plant and other contemplated improvements will cost the company $250,000, and will improve and facilitate the service between Aberdeen, Hoquiam and Cosmopolis.

DOYLESTOWN, PA.—There has been a reorganization of the Newtown Electric Street Railway Company. The corporation will hereafter be known as the Newtown Railway Company. A new charter has been applied for. The officers of the new organization are: president, Thomas P. Chambers; directors, Harry E. Woodman, Alexander Chambers, George C. Worstall, Ashbel W. Watson, Thaddeus S. Kenderdine and Edward H. Buckman.

WHEELING, W. VA.—The stockholders of the Wheeling Traction Company at a meeting elected officers and directors for the coming year. The directors are as follows: T. H. Conderman, B. W. Peterson, J. J. Holloway, H. Clark Ford, Joseph Speidel, William Lipphardt and Louis Stifel. The directors organized by electing Mr. Conderman president; B. W. Peterson and J. J. Holloway, vice-presidents; W. A. Sirley, secretary, and G. O. Nagle, manager.

ATLANTA, GA.—The total receipts of the Georgia Railway and Electric Company for 1906, were $2,321,816.04. Of this, the total amount received by the city, which is two per cent, minus all taxes and licenses, is $30,984.36. The total receipts of the company for the previous year, 1905, were $1,959,899.82 or $361,916.22 less than was received during 1906. The receipts are from fares and tolls collected from passengers and property, electric lights, power and steam heat.

HAVERHILL, MASS.—A deal has been completed whereby the Citizens' Street Railway Company, the Haverhill & Amesbury Street Railway Company, the Salisbury Beach Improvement Company and the Salisbury Land Company have become an organization to be known as the Merrimac Valley Electric Company. This will give a railroad line from Haverhill to the sea on the easterly side of the river, another through the city proper, reaching Amesbury, Plum Island and Parker river.

LA CROSSE, WIS.—The proposed road of the La Crosse & Black River Falls Company to Black River Falls has been abandoned, owing to the construction of a power dam by the La Crosse Water Power Company at Hatfield and the incorporation of other companies for the building of electric roads between La Crosse and points northward. Bonds voted by various towns through which the proposed road was to pass are being returned to the communities which voted them.

WINONA, MINN.—A new rural electric railway between Winona, Minn., and La Crosse, Wis., is promised in the articles of incorporation of the La Crosse & Winona Traction Company. The company has a capital of $50,000 and is authorized to build and operate interurban railroads for general railroad purposes. The incorporators and officers, with one exception, are residents of Winona. C. M. Morse is president; C. P. Crandall, vice-president; F. H. Sampson, secretary, and C. M. Green, treasurer.

DENVER, COL.—Definite steps to construct an electric line from Canyon City to the top of the Royal Gorge have been taken by the filing of articles of incorporation. The company is incorporated for $1,250,000, divided into 125,000 shares. The enterprise is financed by capitalists from Philadelphia and Kansas City, associated with Canyon City money. The board of directors of the new company is F. D. Heath, James H. Peabody, W. H. Peabody, D. E. Gibson and E. M. Smith, of Canyon City; W. W. Umbenhauer and Thomas J. Budd, of Philadelphia, and Willis Wood and William Huttig, of Kansas City.

ALTON, ILL.—Application has been made for the incorporation of the Prairie State Traction Company by prominent capitalists of Jersey, Greene and Macoupin counties. The capital stock is $6,000. The purpose is to build a cross-state electric line from Roodhouse and Whitehall to Pana, passing through Athensville, Scottsville, Palmyra, Modesto, Virden, Girard, Farmersville and terminating at Pana. The incorporators are connected with banking institutions, and are H. O. Tunison, H. C. Morrow, E. S. Greenleaf, A. P. Grout, James Walker, Scott Etter, George Morrow, Jett A. Kirby and H. M. Bowen. The last named is of Alton. The proposed line will cross the Alton, Jacksonville & Peoria Railway, the Chicago, Peoria & St. Louis Railway and the McKinley system.

EAST ST. LOUIS, ILL.—The McKinley Interurban system has acquired the Mississippi river terminal of the Venice line of the East St. Louis & Suburban system, and the latter system has acquired in turn all tracks and franchises of the McKinley system in East St. Louis. The exchange gives the McKinley system the desired outlet to the Mississippi river that had to be secured before the bridge that is to be built by that company could be erected. But little of the McKinley lines in East St. Louis will be used by the East St. Louis & Suburban Company, and the remainder will be torn up and the streets replaced. McKinley cars will be run through St. Louis as in the past over the tracks of the East St. Louis & Suburban system, and this plan will be continued until the bridge is built over the Mississippi river connecting Venice and North St. Louis.

GRAND RAPIDS, MICH.—Jeremiah W. Boynton's petition for a franchise for an electric railway in Grand Rapids has been submitted to the common council and referred to the committees on streets and ordinances. The road, which will pass through Grand Rapids, is but a link in the chain of the road which Boynton is building from Alpena to Ohio, part of which he already claims to have constructed or under construction. In his petition Mr. Boynton outlined the proposed route as follows: Starting at Alpena, running through West Branch, Gladwin, Mount Pleasant, Edmore, Greenville, Belding, Rockford, Grand Rapids, Kalamazoo, Battle Creek, Coldwater and Camden, and thence into Ohio cities not designated. He also projects a branch line from Grand Haven to Lansing. In his franchise in Grand Rapids, Mr. Boynton asks the right to lay tracks and carry passengers, mail, freight and express.

ELKINS, W. VA.—Two applications for a street car franchise are now before the Elkins city council. Some time ago the Leadville Power Company asked for a franchise, promising to commence the construction of the line within three years, and the ordinance for that purpose is now before a committee. The Elkins Electric Railway Company has also filed an application for a franchise and with it, as an evidence of good faith, a certified check for $5,000, agreeing that if a franchise is granted the company will begin the construction of the street car line within ninety days and, barring accidents, will have the line in operation and cars running over it within one year. It is understood that the new company is composed of capitalists of Cleveland and Pittsburg; that it will take $150,000 to build the line, and that local people, if they desire, will be given a chance to subscribe for the stock of the company on even terms with the incorporators of the company.

INDUSTRIAL ITEMS.

THE LANE & BODLEY COMPANY, Cincinnati, Ohio, has published a new catalogue descriptive of its four-valve shaft governor engine.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., announces the location of its new branch office in New Orleans at 316 Godchaux Building.

THE AMERICAN STEAM PUMP COMPANY, Battle Creek, Mich., will be pleased to send some descriptive literature devoted to "Marsh" boiler feed pumps.

THE H. W. JOHNS-MANVILLE COMPANY, 100 William street, New York city, is describing the "J-M" electric heater and quoting prices in a new series of folders.

THE CHICAGO FUSE WIRE AND MANUFACTURING COMPANY, Chicago, Ill., is distributing bulletin No. 18, devoted to "Union" enclosed fuse blocks and fittings.

THE GENERAL STORAGE BATTERY COMPANY, 42 Broadway, New York city, is issuing a valuable instruction book concerning the installation and operation of transportable batteries.

THE AMERICAN ENGINE COMPANY, Bound Brook, N. J., announces that Hunt, Mirk & Company, of San Francisco, Cal., has taken the agency for American-Ball engines for the Pacific Coast.

THE GAIL-WEBB MANUFACTURING COMPANY, Buffalo, N. Y., is distributing an attractive catalogue and price list devoted to adjustable electric fixtures and portables for complete office and factory equipment.

THE ELECTRIC MOTOR AND EQUIPMENT COMPANY, Newark, N. J., has published a handsome bulletin devoted to electric signs and transparencies. A number of striking installations are illustrated and described.

H. O. KEFERSTEIN, 624 Fourth avenue, Brooklyn, N. Y., has prepared some interesting literature concerning a new type of superheater for steam boilers. This literature will be sent any one interested upon request.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio, has issued an attractive series of bulletins descriptive of the "Gem" metallized fifty-watt lamp, the tantalum lamp, and the "Gem" metallized high-candle-power and "Prismo" lamps and units.

THE ARTHUR JONES COMPANY, Old Colony Building, Chicago, Ill., advises that it has added to its business a maintenance department. This department will make regular inspections of motor installations, making such repairs as may become necessary.

THE H. T. PAISTE COMPANY, Philadelphia, Pa., in its March bulletin describes type "C" and type "D" panel boxes and auxiliary material for fitting up these panel boxes. Illustrations and descriptions are also given of the "Security" snap socket and type "A" panel boxes.

THE AJAX LINE MATERIAL COMPANY, Chicago, Ill., has moved its eastern sales office to room 818, Postal Telegraph Building, New York city. The company will have larger quarters for handling its line of mast arms, arc-lamp insulators, pulleys and incandescent hoods.

THE FRANKLIN ELECTRIC MANUFACTURING COMPANY, Hartford, Ct., announces the opening of an office and stock room at 602 Fisher Building, Chicago, Ill., where a full line of standard reflector, miniature, "Gem" and tantalum lamps will be carried. Charles N. Thorpe will be manager of the Chicago office.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, Chicago, Ill., announces that in order to meet the growing demands of the business, both the president, R. B. Benjamin, and vice-president, W. D. Steele, will henceforth be found at the company's headquarters in Chicago, and divide the responsibilities of its management. Mr. Benjamin will devote himself especially to looking after the manufacturing department, the completion and improvement of the numerous devices which the company is placing upon the market. Mr. Steele will have charge of the commercial department.

THE WESTERN WIRE SALES COMPANY, Chicago, Ill., incorporated under the laws of the state of Illinois, has taken over the business, good-will, assets, agencies, etc., of J. Allen Haines, Incorporated, 324 Dearborn street. The offices remain in the same place. In addition to the agencies taken over, this company has added several new agencies and represents in the West one of the large eastern manufacturers of German silver, nickel wire, resistance wire, etc., and the Tipless Lamp Company, New York city. The Western Wire Sales Company is publishing a weekly market letter, which will be sent regularly to any one interested. This letter aims to give information on copper, copper market, new articles which have been put on the market which may be of interest to those connected with the electrical trade, etc.

W. S. BARSTOW & COMPANY, New York city, announces the appointment of Werner Boecklin as one of the principal figures in its recently increased organization. Mr. Boecklin has filled responsible positions in the engineering department of the Fort Wayne and Burlington systems in connection with important and extensive improvements, as engineer. He has also been connected with the Robins Conveying Belt Company, John A. Mead & Company, New York; Dominion Coal Company, Jones & Laughlin Steel Company, Chicago Edison Company, Washington Navy Yard, Interborough Rapid Transit Company, London Underground Railways Company, and the Middletown Car Works. Armin Schotte has also become connected with the Barstow company. Mr. Schotte is a graduate in civil engineering of Lehigh University. He has been connected with the Keystone Bridge Works, Carnegie Steel Company, and was chief engineer of the Expanded Metal Type Company and the National Fireproofing Company, of Pittsburg. He has also had many important appointments as consulting and designing engineer.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is distributing the following series of bulletins: No. 3,100, small induction motors for single-phase current; No. 3,111, single-phase induction motors, light-load automatic start; No. 3,112, single-phase induction motors, full-load automatic start; No. 3,113, single-phase induction motors, condensed type, full-load automatic start; No. 3,114, single-phase induction motors, one-sixth-horse-power, full-load automatic start; No. 3,115, single-phase induction motors, one-eighth to one-sixth-horse-power, full-load automatic start; No. 3,116, single-phase induction motors, one-tenth, one-eighth and one-sixth-horse-power, condensed type, light-load automatic start; No. 3,117, single-phase induction motors, one-sixth and one-quarter-horse-power, full-load automatic start; No. 3,118, single-phase induction motors, one-eighth and one-sixth-horse-power, condensed type, full-load automatic start; No. 3,119, single-phase induction motors, one-quarter and one-third-horse-power, full-load automatic start; No. 3,120, single-phase induction motors, one-half-horse-power, full-load automatic start; No. 3,122, single-phase induction motors, one-quarter to one-half-horse-power, full-load automatic start, with back-geared countershaft. A pocket price book, giving net prices to the trade on Emerson motors and motor applications, is also ready for distribution.

THE BAY STATE INSULATED WIRE AND CABLE COMPANY, Hyde Park, Mass., announces that it has just completed its extensive factories at Hyde Park, and that these will rank with the largest wire mills in the country. The company is ready to manufacture insulated wires and cables of every description. The new and modern machinery will give the company a daily capacity of over 500,000 feet. With the additional machinery now being made, the output will be increased to 1,000,000 feet of finished wire per day. The company states that it will manufacture only the highest grade of wire, which, in insulation, resistance and breakdown test, will equal the best on the market. The president of the company is Andrew J. Conlin, who is well known as an authority in the manufacture of wire, having for the past eighteen years been superintendent of the Simplex Electrical Company, Cambridge, Mass. Before entering the employ of that company he planned the equipment and installed the machinery of the Safety Insulated Wire Company's works now at Bayonne, N. J. He was also rubber expert and superintendent for the India Rubber and Gutta Percha Insulating Company, of Yonkers, N. Y. The treasurer and manager of the company is John H. H. McNamee, formerly mayor of Cambridge, Mass., and well known as a capitalist and an energetic executive. The sales department is in charge of Alfred W. Worthley, who for many years was the associate of the late Henry A. Clark, of the Eastern Electric Cable Company and the Clark Insulation Company.

Record of Electrical Patents.

Week of March 26.

848,006. ELECTRIC CONTROLLER. Roy W. Brown, Amsterdam, N. Y. Contact blocks are imbedded in a concrete cylinder.

848,028. ELECTRIC SWITCH. Gerald W. Hart, Hartford, Ct., assignor to the Hart Manufacturing Company, Hartford, Ct. A snap switch.

848,035. TROLLEY WIRE SLEEVE. Charles W. Ketteman, Dayton, Ohio. The wires are clamped by cams.

848,045. LIGHTNING ARRESTER. James H. Pearson, Bloomfield, Ind. A fuse block with the conductors in capillary passages.

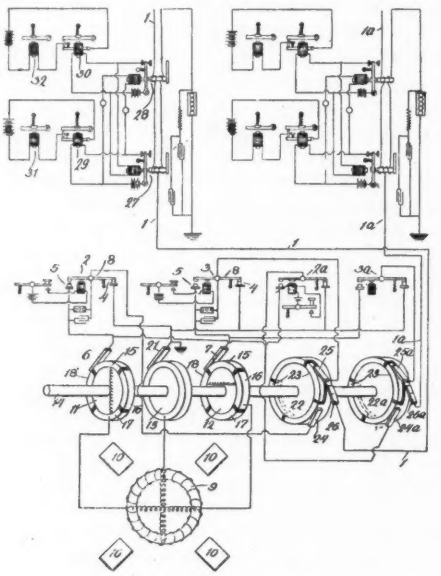
848,047. ELECTRIC CABLE SPLICING AND DISTRIBUTING BOX. Henry E. Procunier, Oak Park, Ill. The cable entrances are at the bottom of the box.

848,073. MODULATING TELEPHONE RECEIVER. Kelley M. Turner, New York, N. Y. Cam lugs press a damping ring against the diaphragm.

848,083. ELECTROCAPILLARY DETECTOR AND RECORDING APPARATUS. James T. Armstrong and Axel Orling, London, England. A double capillary electrometer.

848,085. SPRING CLAMP FOR ELECTRIC TERMINAL WIRES. Horatio J. Brewer, New York, N. Y. A wire clamp.

848,120. AUTOMATIC TRUNKING DEVICE AND SELECTIVE SIGNALING APPARATUS. August A. Monson, St. Paul, Minn. Individual electromagnets at the subscribers' instruments close the circuit.



848,221.—TELEGRAPHY.

848,138. BLEACHING CABINET. Wilmont E. Strong, Tacoma, Wash. An electrolytic flour-bleaching cabinet.

848,148. CIRCUIT-BREAKER. Albert C. Woehrle, New York, N. Y. A vibrator for induction coils.

848,163. ELECTRIC HEATING. Samuel S. Eveland, Philadelphia, Pa. An electric welding device.

848,167. ADJUSTABLE HANGER FOR ELECTRIC DROP LIGHTS. Allen J. Gowan, Norwich, Ontario, Canada. A spring-actuated drum.

848,182. BRUSH-HOLDER FOR MOTORS AND GENERATORS. John Lindall, Boston, Mass. A radial brush-holder.

848,221. TELEGRAPHY. John C. Barclay, New York, N. Y. A multiplex alternating-current system.

848,280. AUTOMATIC TEMPERATURE REGULATOR. Frank A. Beckwith, Evanston, Wyo., assignor of one-third to Rudolph Dumbeck, Salt Lake City, Utah. A thermostatic regulator.

848,283. SWITCHING DEVICE. Jules A. Birsfield, Rochester, N. Y., assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Keys for telephone switchboards.

848,288. SIGN. Hjalmar Christensen, Seattle, Wash. An illuminated sign.

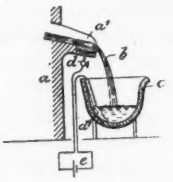
848,292. AUTOMATIC SPEED-CONTROLLED CIRCUIT CLOSURE FOR ELECTRIC GENERATORS. Charles E. Dawson, Indianapolis, Ind., assignor to Artemus W. Fisher, South Bend, Ind. A centrifugal regulator.

848,372. ELECTRIC HOISTING SYSTEM. John D. Ihlder, New York, N. Y., and Rumsey W. Scott, Washington, D. C., assignors to Otis Elevator Company, Jersey City, N. J. An electric elevator.

848,373. SAFETY CATCH FOR ELEVATORS. John D. Ihlder, New York, N. Y., and Rumsey W. Scott, Washington, D. C., assignors to Otis Elevator Company, Jersey City, N. J. The safety brake is controlled by an electromagnet.

848,378. APPARATUS FOR TELEPHONE TOLL LINES. Thaddeus R. Laing, Chicago, Ill., assignor to Kraft Combination Telephone Company, Chicago, Ill. An electromagnetic device for controlling a coin collector.

848,382. OVERHEAD TROLLEY. Allen P. Lord and Nathaniel Wilkins, Bradford, Pa. Oiled bearings are provided.



848,422.—METHOD OF MAINTAINING OR INCREASING THE FLUIDITY OF MOLTEN OR SEMIMOLTEN MATERIALS BY MEANS OF ELECTRICITY.

848,398. AUTOMATIC EXCHANGE SELECTOR. John G. Roberts, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. An automatic telephone exchange selector.

848,405. CURRENT-CONTROLLING APPARATUS. August Sundh, Yonkers, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. A controller for an electric elevator.

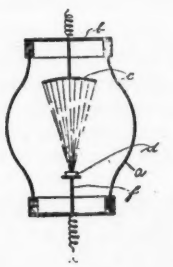
848,422. METHOD OF MAINTAINING OR INCREASING THE FLUIDITY OF MOLTEN OR SEMIMOLTEN MATERIALS BY MEANS OF ELECTRICITY. Frank Wynne, Westminster, London, England. A current is passed through the stream of material.

848,448. TELEPHONE TOLL-LINE SYSTEM. William W. Dean, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. An electromagnetic coin-distributing apparatus is used.

848,468. ELECTRIC RECORDER. David J. Klepfer, Philadelphia, Pa.; Sarah L. Klepfer administratrix of said David J. Klepfer, deceased. A recorder for automatic sprinkler systems.

848,518. ELECTRIC MEDICAL APPARATUS. Carlos Van Bergh, Winnipeg, Manitoba, Canada. An interrupter for medical coils.

848,559. BATTERY PLATE. William G. C. Krause, Waterbury, Ct., assignor to Charles B. Schoenmehl. A battery-plate holder.



848,600.—PRODUCTION OF HOMOGENEOUS BODIES FROM TANTALUM OR OTHER METALS.

848,568. TELEPHONE DETECTOR. Arnold R. Piehn, Alta Vista, Iowa. A detector for indicating which instrument is calling.

848,570. ZINC ELECTRODE. Charles B. Schoenmehl, Waterbury, Ct. A battery zinc.

848,581. CONTROLLER FOR ROLLING-MILL REPEATERS. Frank P. Townsend, Elyria, Ohio, assignor to National Tube Company, Pittsburg, Pa. A controller for rolling-mill motors.

848,600. PRODUCTION OF HOMOGENEOUS BODIES FROM TANTALUM OR OTHER METALS. Marcello von Pirani, Wilmersdorf, Berlin, Germany, assignor to Siemens & Halske A.-G., Berlin, Germany. The metal enclosed in an exhausted vessel is exposed to cathode rays until fused.

848,601. ELECTRIC TROLLEY RETAINER. Edward T. Platt, Chicago, Ill., assignor of one-half to Herman Feldmann, Chicago, Ill. Retaining arms extend above the wheel.

A CORRECTION.

A CORRECTION—In the issue of the ELECTRICAL REVIEW for March 16, the illustration for patent No. 846,223, assigned to Thomas Marshall, Chicago, Ill., was designated as No. 846,422.